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Bureau of Land Management
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June 2003

Draft Supplemental Environmental Impact Statement

Management of Port-Orford-Cedar in Southwest Oregon

Coos Bay, Medford, and Roseburg Bureau of Land Management Districts and the Siskiyou National Forest in Southwest Oregon

Lead Agencies: Bureau of Land Management – U.S. Department of the Interior
Forest Service Region 6 – U.S. Department of Agriculture

Cooperating Agency: Forest Service Region 5, U.S. Department of Agriculture

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or e-mail to:
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Comments must be received by September 12, 2003.

Reviewers should provide their comments during the review period of the draft environmental impact statement. This will enable the Agencies to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decision-making process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewer's position and contentions. Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 552 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement. City of Angoon v. Hodel (9th Circuit, 1986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980). Comments on the draft environmental impact statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3)

United States Department of Agriculture	Forest Service	R-6	OR/ WA	Bureau of Land Management	United States Department of Interior

Reply Refer To: **3400 (FS)/ 5820 (BLM) (OR-935)** **Date: June 6, 2003**

Dear Reader:

This letter announces the release of the Draft Supplemental Environmental Impact Statement (SEIS) for Management of Port-Orford-cedar in Southwest Oregon.

Abstract: *The Coos Bay, Medford, and Roseburg Bureau of Land Management Districts and the Siskiyou National Forest are proposing to amend their respective Land and Resource Management Plans with standards and guidelines for the management of Port-Orford-cedar and the root disease - Phytophthora lateralis. The Draft SEIS considers five alternatives for maintenance of Port-Orford-cedar as an ecologically and economically significant species. Each alternative responds to the Purpose, to the degree such treatments are needed, practical, and cost-effective, of reducing disease introductions, slowing the spread of the disease where present, and/or mitigating the occurrence of the disease. Alternative 1 continues the current direction of implementing available disease-management practices based on site-specific analysis. Alternative 2 uses the same management practices but includes a risk key to clarify the environmental conditions that require implementation of site-specific practices. Alternative 3 includes all elements of Alternative 2, and adds additional protections for 32 currently uninfested 6th field watersheds. Alternative 4 removes existing disease management practices, but accelerates the resistant breeding program to provide resistant stock for all areas within 10 years. Alternative 5 also removes existing disease management practices, and stops development of resistant seed for remaining undeveloped breeding zones.*

Major issues include how effective would management practices be, what resources will be negatively affected by the cedar mortality, and how much restriction of other forest uses are necessary to reduce disease spread. In general, the more restrictive Alternatives 1, 2, and 3 improve conditions for water, fish, wildlife, rare plants, Tribal collections, and plant diversity, and adversely affect recreation access, special forest product collection, timber harvest, fire suppression and fuels management, and costs. The less restrictive Alternatives 4 and 5 have the opposite effect. A major finding of the analysis is that Port-Orford-cedar is not in danger of extirpation under any of the alternatives.

Preferred Alternative: *The preferred alternative is Alternative 2.*

A description of the Purpose, the alternatives considered in detail, and a brief summary of the environmental effects are included in the six-page Summary in the front of the SEIS. A copy of the SEIS and other related information is also available on the SEIS Team website at: http://www.or.blm.gov/planning/Port-Orford-cedar_SEIS/

The Agencies are soliciting comments on the Draft SEIS. Comments will be accepted via hardcopy mail or e-mail, and should be sent to:

Port-Orford-cedar SEIS Team
P.O. Box 2965, Portland, OR 97208

or:

ORPOCEIS@or.blm.gov

The 90-day comment period begins on June 13, 2003, and closes on September 12, 2003. The Agencies ask that those submitting comments on the Draft SEIS make them as specific as possible with references to page numbers and chapters of the document. Comments should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

Comments received in response to this solicitation, including names and addresses, will be considered part of the public record on this proposal and are available for public inspection. Comments, including names and addresses, may be published as part of the Final SEIS. If you wish to withhold your name or address from public review, or from disclosure under the Freedom of Information Act (FOIA), you must state this prominently at the beginning of your written comments. Additionally, pursuant to 7 CFR 1.27(d), any person may request that submissions be withheld from the public record by showing how the FOIA permits such confidentiality. Persons requesting such confidentiality should be aware that under FOIA, confidentiality may be granted in only very limited circumstances, such as to protect trade secrets. The requester will be informed of the Agencies' decision regarding the request for confidentiality. Where the request is denied, the comments will be returned to the requester and the requester will be notified that the comments may be resubmitted with or without name and address. Comments submitted anonymously will be accepted and considered. Anonymous comments do not create standing or a record of participation. All submissions from organizations and business, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be available for public inspection in their entirety.

For further information on this SEIS, contact Ken Denton, Port-Orford-cedar SEIS Team, P.O. Box 2965, Portland, OR 97208; or via telephone at 503-326-2368.

Sincerely,

KENNETH E. DENTON
SEIS Team Leader
Port-Orford-cedar SEIS Team

Table of Contents

Chapter 3&4 — Affected Environment and Effects of Alternatives

Tables and Figures

Acronyms/Abbreviations

ACEC ~ Area of Critical Environmental Concern
BLM ~ Bureau of Land Management
CVS ~ Current Vegetation Survey
EA ~ Environmental Assessment
EIS ~ Environmental Impact Statement
FS ~ U.S. Forest Service
GIS ~ Geographic (mapping) Information System
LSR ~ Late-Successional Reserve
NF ~ National Forest
NOAA Fisheries ~ National Oceanic & Atmospheric Administration-Fisheries (formerly NMFS-National Marine Fisheries Service)
NRA ~ National Recreation Area
POC ~ Port-Orford-cedar
PL ~ *Phytophthora lateralis*
RNA ~ Research Natural Area
RMP ~ Resource Management Plan
Region 6 ~ Forest Service Region covering Oregon and Washington
Region 5 ~ Forest Service Region covering California
SEIS ~ Supplemental Environmental Impact Statement
USFWS ~ U.S. Fish & Wildlife Service
U.S. ~ United States

Summary —

Introduction

This supplemental environmental impact statement (SEIS) presents the environmental consequences of five different strategies to manage Port-Orford-cedar (POC) in southwest Oregon. Each alternative is designed to meet the need for the maintenance of POC as an ecologically and economically significant species on Bureau of Land Management (BLM) and National Forest (NF) lands. Currently, direction in existing land and resource management plans places an emphasis on reducing the spread of POC root disease and maintaining POC through use of a wide variety of management practices generally applied at the project level following site-specific analysis. A proposal to prepare a SEIS to correct previous cumulative effects analysis deficiencies and consider other management alternatives for POC in the Oregon portion of its range was made public on February 10, 2003, through a Notice of Intent published in the *Federal Register* (68[27]:6709-6710). The Notice of Intent provided preliminary information about the proposed action and invited public comment.

The existing POC management direction was included in Agency land and resource management plans adopted in 1989 and 1995, with little visible analysis regarding how well that direction would work at the range-wide and long-term scales. The direction generally incorporates BLM or references Forest Service (FS) guidelines and policies directing development and application of all practicable management practices to control the spread of the root disease, and to develop disease-resistant trees through a breeding program to help replace trees lost to the disease.

Why is the Action Being Proposed?

In March, 2002 a decision by the U.S. Court of Appeals for the Ninth Circuit found that a BLM project-specific environmental analysis had not adequately considered cumulative effects to the health of POC over its entire range in view of reasonably foreseeable actions of the Agency and others. A follow-up decision by the U.S. District Court of the District of Oregon ruled that the EIS for the Coos Bay District resource management plan was inadequate under the "National Environmental Policy Act" (NEPA) because it did not include an analysis of reasonable foreseeable future timber sales and other actions on the root disease and POC. The court went on to enjoin timber sale activities and related road building and maintenance in the project area until

> . . . BLM completes adequate analysis of the direct, indirect, and cumulative impacts on *Phytophthora lateralis* and Port-Orford-cedar.

It's important to note that the court did not necessarily find a deficiency with the current management direction itself, only that the analysis supporting it was inadequate. This SEIS is intended to supply the missing analysis, and it follows that potential alternatives to the current direction need to be analyzed as well in order to provide a context, or range of effects, within which the decision-maker can consider the required analysis and make an informed choice.

What Would It Mean Not to Meet the Need?

To help address this question at least in regards to "no management", a passive management alternative was analyzed. This alternative has no special management for POC and its root disease and stops the existing resistance breeding program at its current level. Analysis indicates, however, that even this alternative would not lead to extirpation of POC or loss of unique genetic variations. There are other effects however. It appears that a fairly wide range of alternatives will meet the Need, although alternatives that are overly restrictive would not meet the Agencies multiple-use mandates. The analysis displays the positive and negative impacts of each alternative so the decision-makers can choose the one best meeting the purpose of supplying the most cost-efficient balance of positive and negative effects.

What Action is Proposed?

The Agencies propose to amend the land and resource management plans for the Coos Bay, Medford, and Roseburg BLM Districts and the Siskiyou National Forest by removing the existing direction for management of POC root disease and replacing it with the direction in Alternative 2. Alternative 2 describes all currently available control and mitigation practices, dividing them between those that should be applied generally and those that may, depending upon site conditions, be applied to specific management activities. For the latter group, a risk key is included to clarify the environmental conditions that require implementation of one or more of the listed disease-controlling management practices. The difference, when compared with the current direction, is implementation of a slightly broader, potentially more effective array of control or mitigation treatments, and more consistent implementation of those treatments based on the risk key. Alternative 2 is described in detail in Chapter 2.

Are There Other Alternatives that Would Meet the Need?

Yes. During the scoping phase for this project (February 10 through March 12, 2002) many comments were received both internally and externally. Commenters suggested various ideas for meeting the Need, and many of these are addressed in Chapter 2 under "Alternatives Considered, but Eliminated from Detailed Study". Several of the other submitted ideas were incorporated into alternatives considered in detail. The five alternatives considered in detail in this SEIS, including the current direction and the proposed action described above, are summarized in Table S-1.

What are the Effects of the Alternatives?

The environmental consequences of the five alternatives are discussed in detail in Chapter 3&4 and summarized on Table S-2. The most important finding of the analysis is probably that POC is not at risk of extirpation in any portion of its range. POC is at significant risk of root disease infection only on high risk sites. High risk sites are low-lying wet areas that are located downslope from already infested areas or below likely sites for future introductions, especially roads. They include streams, drainage ditches, gullies, swamps, seeps, ponds, lakes, and concave low-lying areas where water collects during rainy weather. (POC away

Table S-1.—*Summary of alternatives considered in detail*

Alternative	Project Analysis	Practices to be Applied	Resistance Breeding [1]
1 - Current Direction	Site-specific.	All known disease-control practices, as needed, and mitigation planting as available. Includes many not described in Standards and Guidelines.	Current level
2 - Proposed Action	Site-specific with risk key to guide analysis and set limits.	All known disease-control practices, as needed, and mitigation planting as available. Current practices are all described in Standards and Guidelines.	Current level
3	Site-specific with risk key to guide analysis and set limits.	All known disease-control practices, as needed, and mitigation planting as available. Current practices are all described in Standards and Guidelines. Also identifies 32 currently uninfested watersheds for further access limitations and no timber harvest in POC stands.	Current level
4	Site-specific only to determine where to use resistant stock.	Only planting of resistant stock where mortality has had the most adverse impact. No disease-control practices.	Accelerated level
5	Site-specific only to determine where to use existing resistant stock.	Only planting of existing resistant stock where mortality has had the most adverse impact. No disease-control practices.	Use existing developed sources only

[1] Current level will develop disease-resistance seed for all breeding zones within 45 years. Accelerated level will develop this same seed within 10 years. Use of existing developed sources only will maintain the existing seed orchard covering 5 of the 19 breeding zones in Oregon, but stop any further field identification of resistant parents and development of additional zones.

from such areas, or near streams or bodies of water, but whose roots do not extend below the high water mark for flooding, are at low risk of infection.)

There are approximately 272,000 acres containing POC in Oregon, with about 33 percent on high-risk sites (including 12 percent currently infested). The percent of the area in high-risk sites varies across the range, from 20 percent in the northwest where POC grows across the landscape, to 60 percent in the Inland Siskiyou region where POC is more concentrated in riparian areas. The management direction in the various alternatives would affect the percentage of high-risk sites that will become infested by the root disease. According to predictions detailed in the Pathology section of Chapter 3&4, the percentage of currently uninfested high risk areas that will become infested in the next 100 years is 40, 35, 20, 80, and 80 percent for Alternatives 1, 2, 3, 4, and 5, respectively. From these projections, and the POC acreage, percent in high-risk sites, and existing infestation rate, the acres and percent of area expected to be infested in 100 years under each alternative can be calculated (see Table S-2).

The various predicted root disease infestation rates and resultant POC mortality have "indirect" effects to various ecosystem processes and values that vary by alternative (see Table S-2). It is important to note that these indirect effects do not all occur at once, but occur over the next 100 years as the disease advances into new areas. There are also "direct" effects from the standards and guidelines themselves. Closing roads or prohibiting timber harvest directly affects forest users, outputs, and jobs. In general across the range of alternatives, as the negative direct effects increase, the negative indirect effects decrease, and vice versa (Table S-2).

Can Any of the Adverse Effects be Mitigated?

Chapter 2 includes a detailed discussion of possible mitigation measures for each of the potential and likely adverse effects identified in the SEIS. In particular, however, Alterna-

Table S-2.—***Summary and comparison of the environmental consequences (effects) of the alternatives***

Resource/topic	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Pathology	54,990 acres [20%] infested in 100 years, 61% of high-risk riparian.	52,120 acres [19%] infested in 100 years, 58% of high-risk riparian.	43,520 acres [16%] infested in 100 years, 49% of high-risk riparian.	77,930 acres [29%] infested in 100 years, 87% of high-risk riparian.	77,930 acres [29%] infested in 100 years, 87% of high-risk riparian.
Ecology	Losses in species diversity and ecological function in one or more of 64 identified plant associations where POC is a major component [prominent]; more of a concern in ultramafic soils where POC is a major component; effect by alternative is proportional to acres infested; no plant association is eliminated.				
Botany	There are probably benefits to some rare plants proportional to decreased infestation acres. Also Alternatives 1, 2, and 3 road closures reduce noxious weed introductions and trampling. However, some rare plants benefit when nearby cedars die. No negative effects to threatened and endangered plants are identified.				
Water and Fisheries	Increased temperature in ultramafic areas results in coho salmon [ESA listed] and steelhead loss, with some effect in all alternatives, increasing towards Alternatives 4 and 5. Less than 5% of coho spawn in ultramafic streams, but temperature increases affect other parts of the system. Alternatives 1, 2 and 3 possible localized mortality of salmonids from Clorox in fire suppression water drops.				
Wildlife	There are no species dependent upon POC, and no adverse effect on threatened and endangered species. Because pure stands are the exception, effects are minimal. In Alternative 3, late-successional forest-related wildlife benefits from reduced timber harvest, but reduced Late-Successional Reserve thinning could slightly reduce future habitat for these same species. Alternatives 1, 2, and 3 possible localized mortality of aquatic species from Clorox in fire suppression water drops.				
Genetics	POC survival in all alternatives is sufficient to avoid loss of common genes and prevent large-scale population divergence.				
Resistance	Good major gene resistance and early fruiting of POC, plus very limited genetic variability in the pathogen, predicts successful development of durable resistant stock for replanting infested areas				
	Stock available in all breeding zones within 45 years.			Stock available in all breeding zones in 10 years.	Stock limited to current level [26% of breeding zones].
Fire and Fuels	Increased suppression and fuel treatment costs about 2 percent [Alternative 3 slightly more]. Alternative 3 would reduce access to 60,000 acres and prohibit timber harvest on 2,300 acres of wildland-urban interface.			No costs associated with POC disease control [possible fuels increase associated with mortality is insignificant].	
Recreation, Visual, Wilderness, and Wild and Scenic Rivers	Negative effects to some users if roads and areas closed; greatest in Alternative 3. Positive effects to visuals, wilderness, and wild and scenic river values [esthetic] of reduced mortality.			No restrictions on access. Esthetic impacts increased.	No restrictions on access. Esthetic impacts increased.
	Resistance breeding mitigates esthetic impacts over time, fastest in Alternative 4; not all areas in Alternative 5.				
Cultural Products for Tribes	Insignificant difference between alternatives because of modest levels used and access on other lands.				
Special Forest Products	Current level [4% of bough market], plus firewood and other collections.	Current level of bough collection, and <5% reduction of firewood and other collections.	Current level of bough collection, and slightly more reduction in firewood and other collections than Alternative 2.	Increase of bough harvest by 100 to 200 tons, plus slight increase in firewood and other collections from current levels.	
Timber Harvest	Increase in cost to purchasers of about $0.80/thousand board feet.				
			Decrease in PSQ approximately 0.7 million board feet and no thinning in 2,300 Late-Successional Reserve acres.		
Direct Costs	$860,000	$846,000	$881,000	$477,000	$93,000
Environmental Justice	Current level	Slight job decrease	Job decrease includes 8 timber jobs	Job increase of 6 related to bough collection	

Note: The planning area includes 1.5 million acres of Federal lands and 272,000 acres with some level of POC stocking, 22,000 of which are infested with root disease.

tives 1, 2, 3, and 4 include a resistance breeding program, and Alternative 5 would continue to use resistance stock in the 26 percent of the breeding zones for which it has already been developed. The Agencies expect the resistance breeding program to mitigate at least some, and potentially many, of the adverse indirect effects at least in the long term, as POC killed by the disease are gradually replaced by planted resistant stock and their offspring. Alternative 4 is scheduled to have seed for all breeding zones within 10 years, while Alternatives 1, 2, and 3 are scheduled to have seed for all zones within 45 years. Although there are long-term uncertainties in any resistance breeding program, the chance for durable resistance in POC is good because it appears to have major gene resistance, the disease itself has a very narrow genetic base indicating a low likelihood of it adapting to kill resistant trees, and POC begins to produce cones as early as age 5 which makes a rapid breeding program possible.

The first resistant POC will be field planted in the Biscuit Fire area in 2004, but even these will take several decades before they fulfill many of the ecological functions of their lost predecessors. The ability of resistant seedlings to mitigate disease losses will depend on Agency funding, time, and on where the Agencies use them. Fortunately, every dead tree need not be replaced by direct planting. POC's propensity for seed production at a young age means successful plantings of a few dozen resistant trees in an infested area should be sufficient to begin a cycle of natural regeneration of resistant or partially-resistant stock.

What Factors Will be Used in Making the Decision Between Alternatives?

The BLM State Director and the FS Regional Forester will decide which alternative best meets the underlying need for this proposal. In making the decision, they will also weigh how well each of the alternatives meets the following purpose:

To meet the Need for maintenance of POC as an ecologically and economically significant species on BLM and NF lands, the Agencies are seeking a management strategy that, to the degree such treatments are needed, practical, and cost-effective, reduces disease introductions, slows the spread of the disease where present, and/or mitigates the occurrence of the disease on POC. Cost-effectiveness is determined by:

- Whether the treatments themselves are practicable;
- whether factors outside the Agencies' control influence the effectiveness of specific measures;
- the significance of the role POC plays in aquatic and terrestrial ecosystems;
- the commercial value of POC; and
- weighing these benefits and factors against the costs of the treatment program.

Also, any strategy for controlling the disease must allow the Agencies to meet their multiple-use mandates, including:

- Providing access to POC products;
- avoiding unnecessary restrictions to public access and use;
- providing for continued extraction of a wide range of products;
- permitting fuel reduction and forest health treatments; and
- conducting fire suppression activities.

Reduced ability to meet these mandates will be considered as part of the costs of the treatment program.

What Monitoring is Necessary?

Monitoring is specified as part of each of the alternatives. Where applicable to the specific elements of an alternative, this monitoring includes tracking the success of the resistance breeding program, annual program summaries and evaluation reports, and incorporating POC management requirements in all regularly-scheduled project-implementation monitoring. Pathologists will continue to evaluate the effectiveness of existing root disease control techniques and help develop others. The Agencies will continue to maintain infestation maps and forest inventories to track progress of the disease.

Which Alternative is Preferred?

Based on consideration of the environmental consequences in the draft SEIS, Alternative 2 was found to best meet the Purpose and Need, and is the preferred alternative.

Chapter 1 — Introduction, Purpose, and Need

Introduction

This supplemental environmental impact statement (SEIS), prepared jointly by the Oregon/Washington U.S. Department of the Interior (USDI)-Bureau of Land Management (BLM) and U.S. Department of Agriculture (USDA)-Forest Service (FS) Region 6, assesses management alternatives for Port-Orford-cedar within BLM districts and one national forest (NF) in Oregon. A decision selecting one of the Action Alternatives from this SEIS would amend the land and resource management plans for the Coos Bay, Medford, and Roseburg BLM Districts, and the Siskiyou NF. The responsible officials are the BLM State Director for Oregon/Washington and FS Regional Forester for Region 6. The Klamath NF, Six Rivers NF, and Shasta-Trinity NF of Region 5 are Cooperators.

Background

Port-Orford-cedar (*Chamaecyparis lawsoniana* [A. Murr.] Parl.) (Port-Orford-cedar will hereafter be abbreviated POC) is an ecologically and economically important tree species. Its natural range is geographically limited to southwestern Oregon and northwestern California (Figure 1-1), but within that area, it occupies a broad environmental range. Except in the northern part of its range where it is widespread, POC grows primarily along streams and in areas with year-round seepage. It often grows within the active stream channel, where, as large, old trees, it provides shade and long-lasting stream structure (Hansen et al. 2000). POC can be found on ultramafic soils (serpentines) as well as on non-ultramafic soils. Its unique ability to grow well on ultramafic soils makes it the largest tree on many sites, and therefore important for contributing shade and coarse wood in certain stream systems, and for contributing snags and large logs to terrestrial habitats. POC occurs in association with many rare plants, most notably in plant associations on ultramafic soils where it is often the only large conifer. By recycling calcium onto the surface soil, POC may help improve soil fertility, an important quality in harsh ultramafic environments (Ullian and Jules 2000).

Top quality POC logs are currently valued at $2,500 per thousand board feet, and have been valued as high as $12,000 per thousand board feet. Properties of POC wood that make it valuable are its precise machining capability, decay resistance, resistance to chemical corrosion, and aromatic quality. POC is valued in Japan where it is used as a substitute for hinoki cypress (*Chamaecyparis obtusa*) in traditional construction and in the reconstruction of temples and shrines (Hansen et al. 2000).

POC plays a significant role in the cultural, medicinal, and religious life of many Tribes that live within its range. Because of its durability, POC is still used to construct living and sweat houses, both of which hold ceremonial functions. American Indians use many parts of the POC tree: Buds are used to heal sore lungs, throats, and toothaches; leaves are used to treat coughs; and bark and twigs are used to treat kidney problems. Regalia items used in religious

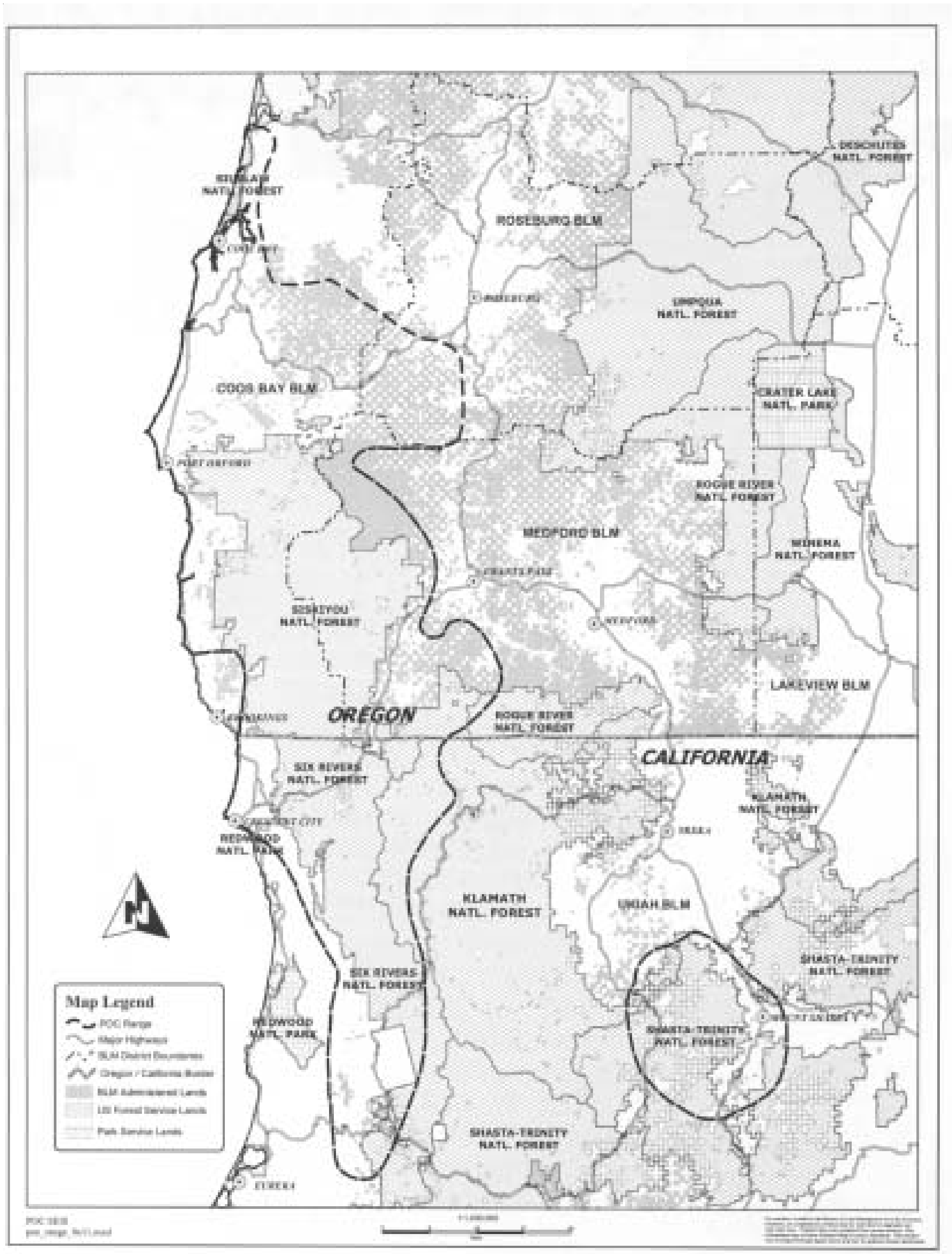

Figure 1-1.—*The range of Port-Orford-cedar in Oregon and California*

ceremonies are made from the wood. Other items, such as feathers and hides, are stored in POC trunks because the oils and aroma of the wood repels insects (Heffner 1984).

POC is affected by an exotic root pathogen, *Phytophthora lateralis* (*Phytophthora lateralis* will hereafter be abbreviated PL), which was first documented in a nursery near Seattle, Washington, in 1923. Nearly always fatal to the trees it infects, research shows the spread of the pathogen is linked, at least in part, to transport of spore-infested soil by human and other vectors. Water-borne spores then readily spread the pathogen downslope and downstream. Other vectors include animals, but the spread associated with them is slower and more localized. The pathogen spread south from Seattle via infected nursery stock and infested soil, and was first reported in the natural range of POC in 1952 near Coos Bay, Oregon. By 1960, infected trees were found on the Siskiyou NF, and surveys in 1964, 1974, 1983, and 1986 showed increasing levels of infestation and tree mortality. Infected trees were first identified in California in 1980. The pathogen now infests about 9 to 15 percent of the federally-administered POC acreage within the range. Much of this acreage is on sites, such as along streams and roads, at high risk to spread the pathogen. Although the disease has spread throughout much of the range and continues to infect more trees in drainages where it is present, approximately 85 to 90 percent of Federal POC acreage is currently uninfested. This is in part because the disease does not readily move above roads or upslope from streams unless carried by some vector, and some trees have a natural resistance to the disease.

In the late 1980s and early 1990s, public awareness of POC and the root disease affecting it reached a high level. In response to public interest and the Agencies' own concerns, the FS and BLM greatly increased their efforts to reduce new occurrences of PL and to maintain POC as an ecologically and economically significant species. Specific management direction was added to each Agencies' land and resource management plans. In general, this direction relies on site-specific analysis at the project level to decide what disease-control or mitigation practices are needed in each situation. Available practices include:

- Washing equipment and Agency vehicles traveling between infested and uninfested areas;
- closing roads to prevent nearby stands from becoming infested;
- limiting access and activities to the dry season;
- treatment of water drawn for roadwork or fire suppression;
- removing POC from along roads to reduce the likelihood of spreading the infestation;
- planting on low-risk sites;
- eradicating the host cedar around infections in order to isolate the infested area; and
- selective breeding to take advantage of the natural resistance exhibited by some trees.

The disease appears destined to eventually spread to high-risk areas over much of the range of POC regardless of efforts to contain it. PL is persistent in the soil for at least several years, and can be transported by animals, hunters, and other vectors even to areas that have no roads. Agency actions can reduce the rate of spread and the percent of trees affected within given areas, but the effectiveness of these actions varies for a variety of reasons. For example, on wetter areas in the northern part of the range, infected and uninfected POC are well-distributed across the landscape and regenerate readily on disturbed sites including road cuts and fills. Where such conditions exist on "checkerboard" Federal lands intermingled with private lands, timber hauling and other public use is unrestricted on public and permit roads across Agency lands. Hence, many of the techniques the Agencies might use, including washing vehicles, removing host trees adjacent to roads, or limiting activities to the dry season, are not available or are less effective on these checkerboard ownerships, or are not cost-efficient given the relatively small gain in protection. Regardless of the level and effectiveness of Agency actions, it is unlikely the disease will kill all POC trees because (1) they produce massive amounts of seed, (2) many trees are located upslope from roads and streams or on drier areas unfavorable to the pathogen, or (3) they are naturally resistant to the disease.

A small percent of POC appear resistant to the disease. In resistance tests as old as 16 years, a majority of tested seedlings continue to survive in infested soil. An operational resistance breeding program started by the FS and BLM in 1997 has developed resistant populations. Breeding is advancing relatively quickly, in part because POC can develop seed cones at 4 or 5 years of age or sooner. Resistant seed has been sown in containers to be used to restore areas burned in the 2002 Biscuit Fire in southwest Oregon.

In 2002, a decision by the U.S. Court of Appeals for the Ninth Circuit found that a BLM project-specific environmental analysis (EA) did not adequately consider cumulative effects to the health of POC over its entire range in light of the reasonably foreseeable actions of the Agencies and others. This decision held that even though there is existing management direction to limit the spread of the disease, and even though the Agencies have been vigorously implementing that direction, there needs to be consideration of the cumulative range-wide effects of the current management direction and other reasonably foreseeable actions, not just a consideration of the effects within the immediate geographic area affected by the proposed project. It follows that potential alternatives to the current direction need to be considered as well. This SEIS examines the current POC management direction, and alternative strategies, designed to maintain POC at desired levels in the ecosystem and mitigate the root disease damage.

The Need

The Need to which the Agencies are responding remains the same as in the late 1980s and early 1990s when the Agencies adopted their current management direction. The Agencies have a need, in response to public interest and their own concerns, for maintenance of POC as an ecologically and economically significant species on BLM and NF lands. POC plays a key role in some forest ecosystems, provides culturally significant products for Tribes, and provides unique forest products.

It is important to note that the Agencies' Need for maintenance of POC has not been created by a previous management action, law, or even a change in societal priorities. The Need arises primarily from the progressive mortality of POC from an introduced pathogen that seems destined to spread over much of the range of POC. The Agencies have an opportunity to affect how fast the disease will spread across the range at least in the short term, and in most areas whether it will reach some trees at all. The Agencies also have an opportunity to mitigate some of the damage caused by the disease by developing disease-resistant planting stock to replace disease-killed trees.

The Purpose

To meet the need for maintenance of POC as an ecologically and economically significant species on BLM and NF lands, the Agencies are seeking a management strategy that, to the degree such treatments are needed, practical, and cost-effective, reduces disease introductions, slows the spread of the disease where present, and/or mitigates the occurrence of the disease on POC. Cost-effectiveness is determined by:

- Whether the treatments themselves are practicable;
- whether factors outside the Agencies' control influence the effectiveness of specific measures;
- the significance of the role POC plays in aquatic and terrestrial ecosystems;
- the commercial value of POC; and
- weighing these benefits and factors against the costs of the treatment program.

Also, any strategy for controlling the disease must allow the Agencies to meet their multiple-use mandates, including:

- Providing access to POC products;
- avoiding unnecessary restrictions to public access and use;
- providing for continued extraction of a wide range of products;
- permitting fuel reduction and forest health treatments; and
- conducting fire suppression activities.

Reduced ability to meet these mandates will be considered as part of the costs of the treatment program.

This SEIS analyzes a range of alternatives that would meet the Need, and variously would meet elements of the Purpose. Meeting the Need does not necessarily require a change in the current management direction. Arguably, all that is missing from the current direction is a determination of the range-wide environmental effects of that direction and an informed decision by the responsible officials. The No-Action Alternative in this SEIS is not just presented as a point from which to measure the effects of the Action Alternatives; it is also expected to meet the Purpose and Need. Other alternatives in this SEIS provide either higher, lower, or different kinds of protection and mitigation measures than the No-Action Alternative.

Issues

The following Issues are part of the above Purpose, but are more specifically itemized here to help direct the affected environment and effects discussions in Chapter 3&4.

1) What are effective management strategies to maintain POC in the ecosystem?

2) How are aquatic and terrestrial ecosystems affected by the loss of POC?

3) Should certain activities be restricted or modified in consideration of POC, including:

a. POC product harvest, such as boughs and wood;
b. fuels treatments or fire suppression activities;
c. off-highway vehicles and other recreation use and access;
d. special forest products not specifically related to POC, such as firewood collection and mushroom picking; and
e. forest management activities?

4) How does the management of both Federal and non-Federal lands over time affect POC?

5) Should the management strategy be different in parts of the range where conditions vary?

6) Is the management strategy cost-effective?

7) Will the management strategy meet Tribal needs for culturally significant products?

Information about these issues and how each is affected by the alternatives is included in the effects discussions in Chapter 3&4.

Scoping

Scoping is the term used to identify issues, concerns, and opportunities associated with the proposed action in an EIS. Public involvement in the scoping process began when the Notice of Intent to prepare this SEIS was published in the *Federal Register* (68[27]:6709–6710) on February 10, 2003. The Notice of Intent announced the SEIS would develop alternative management strategies for the Oregon portion of the POC range and analyze effects of those strategies throughout the entire natural range of the species. The Notice described scoping as the time to identify interested and affected individuals and groups, and to identify issues associated with the management of POC. The Notice of Intent and scoping letter was posted to the SEIS website on February 10, 2003, at http://www.or.blm.gov/planning/Port-Orford-cedar_SEIS/. Also on February 10, the Agencies distributed news releases to approximately 68 newspapers or radio stations within or near the range of POC, and began mailing approximately 600 scoping letters to individuals, groups, government agencies, and Tribes identified from District and Forest "interested publics" lists as potentially interested in the management of POC on Federal lands in Oregon (see the Culturally Significant Products for American Indian Tribes section in Chapter 3&4 for more detail about Tribes). The letter provided additional detail about the need and the analysis, explained how to remain on the Agencies' mailing list for the draft SEIS and related documents, gave the SEIS website address, and again invited public input.

The Agencies received 77 letters or e-mail messages asking to be on the mailing list; 63 of those also contained other scoping-related comments. These scoping letters helped define the issues and design the alternatives presented in Chapter 2 of this SEIS.

Chapter 2 — The Alternatives

Introduction

This chapter presents five alternatives for the management of Port-Orford-cedar (POC) on the Coos Bay, Medford, and Roseburg Bureau of Land Management (BLM) Districts and the Siskiyou National Forest (NF). Selection of one of the Action Alternatives would amend the land and resource management plans of those four administrative units. The alternatives apply only to lands administered by those four units and to 5,400 acres belonging to the Coquille Indian Tribe that must, by law, be managed according to the standards and guidelines of the adjacent BLM lands. The alternatives would not amend any of the standards and guidelines for management of late-successional and old-growth-forest-related species adopted in 1994 as the Northwest Forest Plan.

Background/Existing Port-Orford-Cedar Standards and Guidelines

POC root disease was first identified near the northwest corner of the POC range near Coos Bay in 1952. POC in this part of the range are often well-distributed across the landscape, but typically make up only a small percentage (usually less than 5 percent) of the composition in any given stand of trees. Trees growing away from roads and streams are not as vulnerable, and those killed near roads and streams are often quickly replaced by other species. After 50 years of disease spread in the Coos Bay area, 70 to 80 percent of the trees are uninfected and the rate of disease spread has slowed.

In succeeding years, the disease moved south and east to the Siskiyou NF and Medford BLM District, and by the early 1980s had reached into the upper Smith River Watershed on the Six Rivers NF in Region 5. POC often makes up isolated remnants in unique habitats (ultramafic soils) or is scattered along the banks of streams and rivers in these areas. As the mortality of POC began to be of greater concern, several publications were issued describing the spread and effects of the disease, and offering strategies for control. These publications included "Port-Orford-Cedar Root Rot on the Siskiyou National Forest" (Harvey et al. 1985); "Siskiyou National Forest Tree Improvement Plan" (Tibbs et al. 1988); "Port-Orford Root Disease" (Roth et al. 1988), and "Ecology, Pathology, and Management of Port-Orford-Cedar (*Chamaecyparis lawsoniana*)" (Zobel et al. 1985). In May 1987, an interregional POC Coordinating Group was formed by the FS and BLM.

On June 29, 1988, in response to concerns about the loss of POC, the FS Regional Foresters of Regions 5 and 6 signed the "Region Five-Region Six Port-Orford-Cedar Root Disease Action Plan." This document was a formal commitment by both Regional Foresters for (1) Inventory and Monitoring, (2) Research, (3) Public Involvement and Education, and (4) Management Policy. This commitment was described in the 1989 "Siskiyou National Forest Land and Resource Management Plan" as providing the support necessary to insure the viability and continued presence of POC in the ecosystem throughout its native range on FS-administered lands.

When the “Siskiyou National Forest Land and Resource Management Plan” was completed in 1989, it referenced the 1988 Action Plan as its primary management strategy for controlling and mitigating the spread of the disease. During the next 6 years, POC and the root disease were extensively mapped, resistance breeding was begun, roads were closed either seasonally or permanently, sanitation treatments were begun along high-risk roads, a test was developed for determining the presence of the disease agent in water and soil, and many other treatments were pioneered and standardized.

Concerned about POC, BLM districts formalized a management approach similar to the FS by developing the “Port-Orford-Cedar Management Guidelines” in 1994 (see Appendix 1). These Guidelines were incorporated into the resource management plans for all three BLM Districts in 1995, without specifically addressing effects to POC in the final environmental impact statements (EISs) for those plans.

In 1995, the FS determined most of the items in its 1988 Action Plan were completed, and declared the Action Plan as ceasing to be operative. Continuing items such as monitoring and public involvement were identified to continue as routine activities, and an oversight and technical team were set up to ensure POC was maintained as

> . . . a viable component of healthy, sustainable ecosystems . . . .

with the BLM as partners.

In general, the current standards and guidelines for both Agencies place an emphasis on reducing the spread of *Phytophthora lateralis* (PL) and maintaining POC through various management practices applied at the project level following project-specific analysis. Although management practices may be locally effective, the disease continues to spread. In 1996 the disease was discovered to have spread to the disjunct population of POC in the Sacramento River drainage, over 150 road miles and in a different river drainage from the nearest known infection center.

The Northcoast Environmental Center, along with several other environmental organizations, filed an action in January 1995 claiming the FS and BLM had failed to comply with the requirements of the “National Environmental Policy Act” in developing their Action Plan and Guidelines, respectively. Plaintiffs sought an order enjoining the FS and the BLM

> . . . to prepare a comprehensive, inter-regional EIS on their management of the Port-Orford-cedar and its habitat . . . [and in the meantime] . . . to undertake all necessary actions to prevent the spread or introduction of *Phytophthora lateralis* and to maintain healthy diverse Port-Orford cedar stands and habitat . . .

which meant all road construction and maintenance, off-road vehicle use, timber harvest, mining, and commercial cedar bough and mushroom collection in the affected area, which encompasses southwestern Oregon and northwestern California. In August 1996, the U.S. District Court ruled that the plaintiffs cannot challenge under the “Administrative Procedures Act” government “programs” in general. The Court found that the alleged “Port-Orford-cedar Program” was a term loosely applied to all the actions that the government took regarding managing POC including public education efforts, research, sharing databases, etc. Such a general program was not a “final agency action” reviewable under the “Administrative Procedures Act.” As to challenges to specific decisions such as the adoption of the “BLM

Port-Orford-cedar Management Guidelines" in the BLM's resource management plan decisions, the Court found that the Guidelines merely contained possible control strategies for root rot disease which managers may or may not select in subsequent site-specific NEPA decision processes. The Court concluded that since the Guidelines did not require district managers to take any action or make any specific proposal or commit any resources, that it was reasonable for the government to determine that the Guidelines did not constitute a major Federal action significantly affecting the quality of the human environment.

Plaintiffs appealed the decision to the Ninth Circuit. The Ninth Circuit in 1998 affirmed the District Court on the grounds that there was no final agency action and that the POC management documents do not constitute a major Federal action affecting the environment. The Court based its decision in part on an assumption that the government agencies would prepare an EIS when they propose to implement particular control strategies with environmental impacts.

The Sandy-Remote Lawsuit

The BLM proposed timber sales during 1996 within a portion of the Coos Bay BLM District known as the Sandy-Remote Analysis Area. The spread of POC root disease was among issues identified in the environmental analysis (EA), with treatments specified to follow the 1994 "Port-Orford-Cedar Management Guidelines." This decision became the subject of a lawsuit, Kern v. BLM, which followed up on the language in the Northcoast Environmental Center decision suggesting that a NEPA action would be ripe when the government took an action implementing a control strategy for managing the cedar root disease. In one of their counts of alleged NEPA violations, the litigants in Kern contended that both the EA and the overriding EIS for the 1995 "Coos Bay Resource Management Plan" contained insufficient analysis of the range-wide cumulative effects of proposed timber harvesting on the spread of the root disease. Although the District Court ruled that the site-specific EA adequately addressed the impacts to cedar within the watershed containing the proposed projects, the Ninth Circuit reversed on the grounds that the EIS to which the EA was tiered did not include an adequate analysis of effects of the adoption of control strategies on the species as a whole, and that the deficiencies of this tiered document were not addressed by the analysis in the EA of only the impacts on the affected watershed.

On February 12, 2003, under direction from the March 2002 decision by the U.S. Court of Appeals for the Ninth Circuit, the U.S. District Court for the District of Oregon ruled that

> . . . the EIS for the Coos Bay District is inadequate under NEPA because it does not include an analysis of reasonably foreseeable future timber sales and other actions on *Phytophthora lateralis* and Port Orford cedar. In the absence of an EIS analyzing the impact of reasonably foreseeable timber sales within the Coos Bay District under the proposed RMP, the Sandy-Remote Area EA is inadequate under NEPA because it lacks an analysis of the cumulative impacts of such sales within the Coos Bay District.

The court went on to enjoin timber sale activities and related road building and maintenance in the Sandy-Remote area that involve harvest of POC until

> . . . BLM completes adequate analysis of the direct, indirect and cumulative impacts on PL and POC.

This supplemental EIS is intended to fully rectify the deficiencies identified in the February 12, 2003 District Court decision and the March 2002 decision of the Ninth Circuit.

The Siskiyou NF has reviewed the Sandy-Remote Decision and, because of the similarity of their land management plan standards and guidelines and related analysis to the BLM plans, has determined similar deficiencies might exist in their plans. Further, because of a history of cooperation between the two Agencies regarding management of POC and the root disease, the Forest chose to participate in this analysis in the hope of adopting the same standards and guidelines as the BLM.

The Supplemental Environmental Impact Statement

The Council on Environmental Quality regulations implementing the "National Environmental Policy Act" (NEPA) direct that agencies supplement an EIS

> . . . if the agency makes substantial changes in the proposed action that are relevant to environmental concerns; or if there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts (40 CFR 1502.9(c)(1)(i) and (ii)).

In this case, there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts. The Agencies need to amend previous land and resource management plan EISs to display the direct, indirect, and cumulative impacts of their current management on PL and POC. It follows that potential alternatives to the current direction need to be analyzed as well, in order to provide a context, or range of effects, within which the decision-maker can consider the required analysis an make an informed choice.

All alternatives would only affect a small portion of the land and resource management plan standards and guidelines, or their supporting EISs, for the affected administrative units. The proposed changes do not constitute an action separate and distinct from the existing land and resource management plans of the Agencies and do not warrant a new EIS. Therefore, it is appropriate to analyze the effects of the Proposed Action and alternatives in a supplemental EIS to the final EISs for the three BLM Districts and one NF affected.

Endangered Species Consultation

The BLM and FS will prepare a biological evaluation for the final SEIS, and consult with the U.S. Fish and Wildlife Service (USFWS) and/or the National Oceanic and Atmospheric Administration (NOAA)-Fisheries to the extent required by the "Endangered Species Act." A draft biological evaluation covering wildlife and botany is in Appendix 7. Listed anadromous fish are discussed in the Water and Fisheries section of Chapter 3&4.

The Planning Area

The planning area for this SEIS is the federally-administered land within the natural range of POC (Figure 1-1) within the Medford, Coos Bay, and Roseburg BLM Districts and the Siskiyou NF, all in southwest Oregon. The selected alternative would also apply to 5,400 acres managed by the Coquille Indian Tribe, because enacting legislation requires these lands to be managed under the same standards and guidelines as the adjacent BLM lands. No management direction is included here for other Federal lands, other American Indian trust lands, or state and private lands. However, cumulative impacts from expected management activities on these other lands, including NFs in California, were considered as part of the effects analysis in this SEIS. NFs in California within the range of POC contributed to the analysis in this SEIS as cooperators. There are no native POC on BLM-administered lands in California.

There will be two records of decision: The State Director for Oregon/Washington BLM will make the decision for the BLM Districts; and the Region 6 Forester will make the decision for the Siskiyou NF.

Relationship of Alternatives to Existing Management Plans

If one of the Action Alternatives is selected, the direction established by the record of decision for this SEIS would remove the existing POC standards and guidelines in the land and resource management plans for three BLM and one FS administrative units (see direction described under the No-Action Alternative, Alternative 1) and replace it with the standards and guidelines of the selected alternative.

Bureau of Land Management

Adoption of the Proposed Action would be consistent with 43 CFR 1610.5-5 and would amend the resource management plans for the Medford, Coos Bay, and Roseburg Districts in Oregon. Because the action alternative would modify only a small portion of each of these resource management plans, plan revisions would not be necessary (43 CFR 1610.5-6).

When a decision is made to prepare an EIS, the amending process follows the same procedure required for preparation and approval of the plan (43 CFR 1610); consideration is limited to that portion of the plan being considered for amendment. The BLM resource management planning process includes nine steps—the planning steps that pertain to this SEIS include:

- Issue identification;
- data collection;
- formulation of alternatives;
- estimation of effects;
- selection of the Preferred Alternative; and
- selection of the proposed plan amendment.

If several plans are being amended simultaneously, a single EIS may be prepared to cover all amendments (43 CFR 1610.5-5).

Forest Service

Adoption of the Proposed Action would result in amendment of the "Siskiyou National Forest Land and Resource Management Plan" (forest plan) in Region 6.

If an amendment to a forest plan results in a significant change in the plan, the "National Forest Management Act" and its 1982 implementing regulations under which this SEIS is prepared, require that the amendment process follow the procedures used in the initial development of the plan. If the proposed change in the plan is not significant, public notification and completion of the NEPA procedures are still required (16 USC 1604 (f)(4) and 36 CFR 219.10(f)). Significant change in the plan is determined by different criteria than those used in evaluating significance in the NEPA process. For the "National Forest Management Act" requirement, the Forest Service Manual (FSM 1922.51 and .52) provides specific direction as follows.

> <u>FSM 1922.51 – Changes to the Forest Plan that Are Not Significant.</u>
>
> 1. Actions that do not significantly alter the multiple-use goals and objectives for the long-term land and resource management.
>
> 2. Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management.
>
> 3. Minor changes in standards and guidelines.
>
> 4. Opportunities for additional management practices that will contribute to achievement of the management prescription.
>
> <u>FSM 1922.52 – Changes to the Forest Plan That Are Significant</u>.
>
> 1. Changes that would significantly alter the long-term relationship between levels of multiple-use goods and services originally projected (36 CFR 219.10(e)).
>
> 2. Changes that may have an important effect on the entire forest plan or affect land and resources throughout a large portion of the planning area during the planning period.

None of the alternatives would result in a significant change to the Siskiyou forest plan. The alternatives would not significantly alter the multiple-use goals and objectives for the long-term land and resource management. Changes in management prescriptions would not result in significant changes (in part because the additional protection areas of Alternative 3 are mostly located in reserves), and changes to the standards and guidelines would be minor, better contributing to achievement of the forest plan objectives. The alternatives would not significantly alter the long-term relationship between levels of goods and services originally projected, and would not have an important effect on the entire forest plan or affect resources throughout a large portion of the planning area.

The Alternatives

Overview

There are five alternatives introduced here and described in detail in following sections. These alternatives apply to the Medford, Coos Bay, and Roseburg BLM Districts and the Siskiyou NF. If one of the Action Alternatives is adopted, the standards and guidelines of that alternative would replace the existing standards and guidelines for management of POC. Management direction for the Klamath, Six Rivers, Shasta-Trinity, and Suislaw NFs is not being considered for change at this time—their current direction is used in the effects discussions in later sections of this SEIS.

Alternative 1 — Continue Existing Direction (the No-Action Alternative): This alternative continues the current direction in the land and resource management plans of the BLM Districts and the Siskiyou NF. In general, these standards and guidelines place an emphasis on reducing the spread of PL and maintaining POC through various management practices applied at the project level following project-specific analysis. As a result, POC root disease control is considered, and control techniques are applied, at all levels of project planning and execution, including firefighting. A summary of specific control or mitigation efforts implemented by the Agencies in Fiscal Years 2001 and 2002 is included in Appendix 2, and serves as the assumed approximate level of management activity that would continue to occur under this alternative.

Alternative 2 — Proposed Action: This alternative specifically describes all currently available control and mitigation practices, dividing them between those that should be applied generally (such as community outreach and restoration) and those that may, depending upon site conditions, be applied to specific management activities (such as timber sales). For the latter group, a risk key is included to clarify the environmental conditions that require implementation of one or more of the listed disease-controlling management practices. The difference, when compared to Alternative 1, is implementation of a slightly broader, potentially more effective array of control or mitigation treatments, and more consistent implementation of those treatments based on the risk key.

Alternative 3: This alternative contains the management elements of Alternative 2, and seeks to slow the spread of PL even more by adding additional protection for 32 currently uninfested 6th field watersheds having at least 100 acres of stands containing POC. Specific protection measures are prescribed for the POC stands within these watersheds (POC core areas), and somewhat different protection is prescribed for the remainder of these watersheds (POC buffers) to lessen the possibility of infection within the POC core.

Alternative 4: This alternative would remove current site-specific measures used to control the root disease spread, but would accelerate the resistance breeding program. The resistance breeding program is designed to supply seedlings to replace (at the same site or elsewhere) POC killed by the disease. Quickly replacing dead POC in natural stands with resistant POC seedlings, and planting microsites at less risk of exposure to PL, would be emphasized.

Alternative 5: This alternative would remove current site-specific measures used to control the root disease spread and discontinue the resistance breeding program. All current management activities described in Alternative 1 would be discontinued except for the operational POC seed production orchards. Seedlings from existing resistant seed orchard trees would continue to be used to reforest areas of mortality occurring in the same breeding zone, but resistant seed for other breeding zones would not be developed.

Standards and Guidelines for Each Alternative

Alternative 1 — Continue Existing Direction

The alternative meets the Council on Environmental Quality requirements for a No Action Alternative described at CFR 1502.14(d).

This alternative continues the current direction in the land and resource management plans of the BLM Districts and the Siskiyou NF. In general, these standards and guidelines place an emphasis on reducing the spread of PL and maintaining POC through various management practices applied at the project level following project-specific analysis. As a result, POC root disease control is considered, and control techniques are applied, at all levels of project planning and execution, including firefighting. A summary of specific control or mitigation efforts implemented by the Agencies in Fiscal Years 2001 and 2002 is included in Appendix 2, and serves as the assumed approximate level of management activity that would continue to occur under this alternative.

The objectives of this alternative are to:

- Reduce the spread of root disease;
- BLM - Retain POC as a species, identify resistant individuals, and incorporate them into a tree improvement program.
- FS - Insure the viability and continued presence of POC in the ecosystem throughout its native range on Forest Service-managed lands.

General Direction

The standards and guidelines for the administrative units in Oregon are displayed as follows. The standards and guidelines for the Cooperating NFs in Region 5 are displayed in Appendix 3, and summarized under Cumulative Impacts near the beginning of Chapter 3&4. Summaries of management practices for other lands, including those administered by the states or by the National Park Service, are also included in the Cumulative Impacts and Background sections in Chapter 3&4.

Existing Direction — Roseburg, Medford, and Coos Bay BLM Districts

Page 60 of the “Roseburg District Record of Decision and Resource Management Plan” (1995) states:

> Conform all management activities within the range of Port-Orford-cedar to the guidelines described in the BLM Port-Orford-cedar Management Policies to mitigate damage caused by *Phytophthora lateralis*. Site specific analyses for projects within the range of Port-Orford cedar will consider possible effects on the species.

Similar language appears on page 75 of the "Medford District Record of Decision and Resource Management Plan" (1995) and page 52 of the "Coos Bay District Record of Decision and Resource Management Plan" (1995).

The "Port-Orford-Cedar Management Guidelines" (1994) document is displayed in its entirety in Appendix 1. It includes the following sections:

I. Introduction
II. *Phytophthora lateralis* and Port-Orford-Cedar
III. *Phytophthora lateralis* and Pacific Yew
IV. Management Objectives for Port-Orford-Cedar
V. Implementation Strategy to Achieve Port-Orford-Cedar Management Objectives
- A. Proactive management: limit the spread of *Phytophthora lateralis* and reduce the number of infested areas
- B. Retain Port-Orford-Cedar as a species, identify resistant individuals, and incorporate them into a tree improvement program
- C. Incorporate *Phytophthora lateralis* control strategies as management objectives in Riparian Reserves, Late-Successional Reserves, and in the Matrix
    1. Riparian Reserves
    2. Late-Successional Reserves
    3. Matrix
- D. Provide Port-Orford-Cedar as a primary forest product
- E. Public Involvement
- F. Develop a budget and implementation schedule for the Port-Orford-Cedar Program

VI. Mitigation Measures for Timber Sale and Service Contracts

APPENDICES
- Appendix 1: Synopsis of Region 5 and 6 Port-Orford-Cedar Coordinating Group Action Plan
- Appendix 2: General Specifications for a Washing Station
- Appendix 3: Equipment Cleaning Checklist
- Appendix 4: Project Analysis and Implementation

ACKNOWLEDGEMENTS
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Existing Direction — Siskiyou National Forest

The following is from page IV-63 of the "Siskiyou National Forest Land and Resource Management Plan" (1989).

> Forest-wide Standards and Guidelines
>
> 12-8: Strategies for POC shall be integrated into environmental analyses and project planning for all areas that support POC. An example is to interplant existing plantations that are scheduled for planting or have been planted. POC should be managed as a major component of the appropriate plant association in areas of low to moderate risk of infection. Representative areas within plant associations containing POC will be identified and protected.

Appropriate practices identified from experience and research should be applied on a site- or drainage-specific basis to prevent or reduce the spread and severity of POC root disease. Additional information and suggested practices can be found in "Port-Orford-Cedar Root Rot on the Siskiyou National Forest" (Harvey et al. 1985); "Siskiyou National Forest Tree Improvement Plan" (Tibbs et al. 1988); "Port-Orford Root Disease" (Roth et al. 1988), and "Ecology, Pathology, and Management of POC (*Chamaecyparis lawsoniana*)" (Zobel et al. 1985).

Of special significance to the support of management of POC was the "Region Five-Region Six Port-Orford-Cedar Root Diseases Action Plan" dated June 29, 1988. This is a formal commitment by both Regional Foresters for (1) Inventory and Monitoring, (2) Research, (3) Public Involvement and Education, and (4) Management Policy. In short, this commitment provides the support to insure the viability and continue presence of POC in the ecosystem throughout its native range on Forest Service-managed lands.

To emphasize the importance of achieving success in this effort, specific examples of requirements are listed below:

1. Silvicultural prescriptions for sites having potential for growing POC will provide for the establishment of the species through natural or artificial regeneration and maintenance as a viable stand component through the current and future rotations. Prescription analysis will also consider distribution of POC so that spacing will inhibit spread of the disease, particularly in susceptible habitats.

2. Road construction and use that can potentially affect POC will be evaluated and appropriate control measures used that limit the spread of the disease. Road closures or controlled access can be used as part of the overall management scheme to reduce the risk of contamination of individual areas (such measures should be documented in the road management objectives).

3. Logging systems used in infested POC stands should minimize disturbance and redistribution of soil. In a given case, this might exclude use of ground-yarding equipment such as tractors or rubber-tired skidders. In other situations, it might require full suspension of logs during yarding operations with skyline systems or helicopters. It might also be necessary to operate during the drier time of the year to reduce soil movement.

The accomplishments of the 1988 "Region Five-Region Six Port-Orford-Cedar Root Disease Action Plan" were reviewed in 1995, with the decision that the majority of the items of the Action Plan had been completed. Specific completed tasks included giving general inventory directions to the affected NFs, establishing local maps, issuing directions for field monitoring, and preparing a report on the effects of mitigation measures. Continuing Action Plan items include active POC/PL forest monitoring programs and collaborating with the BLM, National Park Service, and private landowners.

Alternative 2 — General Direction Plus Risk Key (Proposed Action)

This alternative specifically describes all currently available control and mitigation practices, dividing them between those that should be applied generally (such as community outreach and restoration) and those that may, depending upon site conditions, be applied to specific management activities (such as timber sales). For the latter group, a risk key is included to clarify the environmental conditions that require implementation of one or more of the listed disease-controlling management practices. The difference, when compared to Alternative 1, is implementation of a slightly broader, potentially more effective array of control or mitigation treatments, and more consistent implementation of those treatments based on the risk key.

The objectives of this alternative are to:

- Maintain POC on sites where the risk for infection is low;
- reduce the spread of root disease;
- attempt to reestablish POC in plant communities where it has been significantly reduced in numbers by root disease.

General Direction

Integrated Management Approach. Implement an integrated approach to dealing with PL which includes prevention, restoration, detection, evaluation, suppression, and monitoring. Management goals are directed toward maintaining POC and reducing root disease losses. Elements of the management strategy include management of bough cutting, community outreach, genetics, interagency coordination, planning, wildfire suppression, snag retention, project-specific direction, risk key, management practices, and monitoring.

In portions of the natural range, POC is abundant and widespread across the landscape. In these areas, POC conservation should emphasize management on sites naturally at low risk for infection. In many forest types, management of POC can focus on sites where conditions make it likely to escape infection by PL, even if the pathogen has already been established nearby. POC on such sites often has escaped infection because the sites have characteristics that are unfavorable for the spread of the pathogen. These sites are above and away from roads, uphill from creeks, on ridgetops, and on well-drained soils.

In the majority of the natural range, POC is widespread but not abundant. POC populations are localized on moist microsites (such as along streams) or sites favorable for establishment of the species (such as along roads). In these areas, opportunities for managing for POC on sites unfavorable to the pathogen are limited or do not exist at all. Prevention of new infestations treatments should be emphasized in this portion of the range, and there is a potential for eradication treatments in certain circumstances.

Restoration of Port-Orford-Cedar. Restore POC to sites within its natural range where the species is essential for meeting land and resource management plan objectives for both aquatic and terrestrial ecosystems, Tribal, or product uses or function. This would be accomplished using resistant and nonresistant stock for reforestation and other elements of the integrated management approach.

Adaptive Management. Adaptive management is a continuing process of action-based planning, monitoring, researching, evaluating, and adjusting with the objectives of improving the implementation and achieving the goals of the selected alternative. Under the concept of adaptive management, new information would be evaluated and a decision would be made whether to make adjustments. The Agencies would continue to develop and evaluate techniques to protect POC, and prevent disease intensification and spread within and around areas where PL infestations already occur.

Bough Cutting. To reduce or eliminate the spread of PL by POC bough cutters, limit POC bough cutting to roadside sanitation, commercial thinning, and precommercial thinning units.

POC bough collection shall be by permit only, and require:

- Dry season operations;
- designation of access and egress routes;
- designation of parking areas;
- unit scheduling (collect all uninfested areas prior to infested areas);
- washing of boots and equipment;
- daily inspections;
- stopping operations during and after rains; and
- easily identifiable areas where boughs are to be collected.

Community Outreach. Increase public awareness of the root disease and the need to control it by using periodic press releases; distributing posters and pamphlets; coordinating with Tribal groups; creating and maintaining POC websites; conducting public symposiums; preparing and installing informational signs on or at trailheads, gates, and other closures; holding coordination meetings with industrial and small woodland landowners; and other measures.

Eradication. In watersheds or other geographic areas where PL infestations are localized or infrequent in comparison to the amount of POC, POC eradication may be tried as a management technique to prevent/reduce spread of the disease and reduce the need for other management practices in the long term. When experience demonstrates techniques and conditions where this treatment can be effective, its use will be increased. Prescribed fire may be considered as a part of eradication treatments. PL has been shown to be adversely affected by heat in laboratory studies (Ostrofsky et al. 1977; Hansen and Hamm 1996) and burning may reduce PL in the soil.

Genetics. Develop resistant stock and make it available for all POC reforestation and restoration projects.

The existing interagency resistance breeding program would be continued at current levels (per available funding) as described in a POC interagency agreement between the FS and BLM. The objectives of this agreement are to (1) select and evaluate families for resistance and develop durable resistance to PL while maintaining broad genetic diversity within the species, and (2) produce seed genetically resistant to PL for deployment throughout the range of where PL is present. The POC resistance breeding program would continue as follows:

- Develop resistant seed for **breeding zones** (breeding blocks plus elevation zones) based upon management needs within the range of POC;

- the three BLM Districts and the Siskiyou NF will develop a POC strategic deployment strategy for the planting of resistant POC stock, and include consideration for state and private lands (see Appendix 6);

- continue efforts to inform the public about the availability and use of resistant seed;

- find ways to provide resistant seed to non-Federal landowners; and

- monitor the operational performance of resistant plantings.

Collect and maintain between 50,000 and 100,000 resistant seeds (about 0.5 pound) for each

POC breeding zone in organized conservation seedbanks. This seed would be reserved exclusively for reforesting areas after the occurrence of stand replacement events such as large-scale wildfires. Where possible, resistant POC seedlings would be planted in such locales, with the goal to reintroduce POC to all pre-fire locations.

Interagency Coordination. The Agencies would continue to coordinate management practices including research, genetic resistance breeding, and public education.

Planning. Consideration of POC management objectives would be addressed, as applicable, in new NEPA documents, watershed analyses, Late-Successional Reserve assessments, wild and scenic river management plans, transportation planning (roads analysis process or transportation management objectives), fire management plans, recreation planning, and other activities or strategies in all watersheds with POC.

Wildfire Suppression. POC issues are secondary priority during wildfire suppression. While management objectives for POC are a concern, safety of firefighters and the public, and protection of property is always a higher priority. Existing or "in-place" disease-controlling management practices such as road closures may be compromised. When practicable, management strategies to prevent/reduce spread of PL shall be incorporated into firefighting activities. Such practices may include treating firefighting water with Clorox, washing vehicles, and washing tools and clothing.

Road closures and other compromised POC-disease controlling measures will be reinstalled following suppression and emergency rehabilitation. Fire rehabilitation efforts will include POC and PL considerations.

Snag Retention. Emphasize the retention of POC snags in Riparian Reserves because they are resistant to decay and the resultant down logs can provide durable structural components for both aquatic and terrestrial ecosystems. Retention numbers should consider that few additional large POC snags are likely to become available in the near future in infested areas because of the current mortality and presence of PL. This direction is particularly applicable to plant associations on utramafic soils and other locations where POC can be some of the largest and most abundant trees.

The stabilizing effects and habitat contributions of large POC woody material and its root mass in stream channels has often been described as the primary geomorphic control for soil movement in certain stream systems. Dead POC can provide in-channel structure, a source of nutrients, and a substrate for wood-associated aquatic insects. This allows for maintenance of the stream channel over time and retains anadromous and resident fish habitat.

Avoid Disease Export. Before travelling to or working in relatively less infested areas, such as in uninfested watersheds or different administrative units, heavy equipment, including road maintenance equipment that has left surfaced roads, should be washed upon leaving infested project areas to minimize transport of infested soil to uninfested areas. Washing areas would be located as described under Management Practice 13 (Washing Project Equipment) in the following Management Practices section.

Project-Specific Direction

One or more of the management practices listed under the following Management Practices subheading would be applied to site-specific management activities when a need is indicated by the POC Risk Key, Table 2-1. This approach precludes the need for additional project-specific analysis of risk because the risk key describes conditions where additional protection or mitigation management practices are assumed (expected) to be applied. When a project-specific application of the risk key shows the risk is low, no additional Management Practices are needed.

For the application of this risk key, the definition of "project" should be viewed broadly. Road maintenance, recreation management, non-POC special forest products including personal use firewood, and other general uses likely to introduce significant risk to essential POC should be considered for mitigation treatments when indicated by application of the key.

The objective of the risk key is to identify project areas/situations where new infections should be avoided, and guide the application of one or more of the management practices until the risk is acceptably mitigated. The risk key describes an expectation that appropriate mitigation measures would be applied where needed.

Management practices are designed to:

- Reduce the import of disease into uninfested areas (offsite spores picked-up and carried into an uninfested project area);

- prevent/reduce the export of disease to uninfested areas (onsite spores moved to offsite, uninfested area); and

Table 2-1.—*Port-Orford-Cedar Risk Key: Site-specific analysis to help determine where risk reduction or mitigation treatments would be applied*

1a. Are there uninfected POC within, near, or downstream of the analysis area whose ecological, Tribal, or product use or function is so essential that their mortality would preclude meeting land and resource management plan objectives?	
1b. Are there uninfected POC within, near, or downstream of the analysis area that, were they to become infected, would likely spread infections to trees whose ecological, Tribal, or product use or function is so essential that their mortality would preclude meeting land and resource management plan objectives?	*If the answer to both questions 1a and 1b is no, then risk is low and no POC management practices are required.*
If the answer to either question is yes, continue.	
2. Will the proposed project introduce significant risk of infection to these uninfected POC?	*If no, then risk is low and no POC management practices are required.*
If yes, apply management practices from the list below for reduction or mitigation of risk, until the answer to one of the above questions is no, or until the project analysis indicates no other treatment is effective, no other treatment is practicable, or disease control objectives can be met by other means.	
[1] In questions 1a and 1b, "near" generally means within 25 to 50 feet downslope or 25 feet upslope from management activity areas, access roads, or haul routes; farther for drainage features; considerably farther in streams.	

- minimize increases in the level of inoculum or minimize the rate of spread in areas where the disease is localized or infection is intermittent.

Management Practices

Management practices from the list below would be selected and implemented when there is a management need indicated by the POC Risk Key. No priority is assumed by the order listed below. When indicated by the risk key, one or more specific practices best fitting the nature of the risk and the site-specific conditions would be applied.

1) Project Scheduling: Schedule projects during the dry season or incorporate unit scheduling (Management Practice 3) and vehicle and equipment washing (Management Practice 13) as part of project design.

2) Utilize Uninfested Water: Use uninfested water sources for planned activities such as road watering and other water distribution needs, or treat water with Clorox to prevent/reduce the spread of PL (see Appendix 4 for label and instructions for use).

3) Unit Scheduling: Conduct work in all timber sale and other activity units or areas where PL is not present before working in units infested with PL.

4) Access: Designate access and egress routes to minimize exposure to PL.

5) Public Information: Increase public awareness of the root disease and the need to control it by using informational signs on or at trailheads, gates, and other closures, and holding coordination meetings with adjacent industrial and small woodland landowners.

6) Prescribed Fire: Clean boots, vehicles, and incorporate other management practices to avoid moving infested soil out of treatment areas. Incorporate unit scheduling and vehicle and equipment washing as described in Management Practice 1 as part of project design. Select water sources as described in Management Practice 2. Specify travel routes as shown in Management Practice 4.

7) Incorporate POC Objectives into Prescribed Fire Plans: Incorporate POC objectives (sanitation, etc.) into prescribed fire treatment plans. These include using uninfested or treated water sources and, potentially, aiding with eradication treatments.

8) Routing Recreation Use: Route new trails (off-highway vehicle, motorcycle, mountain bike, horse, and foot) away from areas with POC or PL. Trailheads should be relocated and/or established trails should be rerouted in the same manner where trails present significant risk to POC.

9) Road Management Measures: Implement proactive disease prevention measures including seasonal or permanent road closures, road maintenance, and sanitation removal of roadside POC to help reduce the likelihood of spreading the disease—especially to high risk areas. Identify prevention measures at a site-specific or drainage-specific level. Road design features include pavement over other surfacing, surfacing over no surfacing, removal of low water crossings, drainage structures to divert water to areas unfavorable to the pathogen, and priority retention during thinning or other silvicultural treatments.

10) Resistant POC Planting: Plant resistant POC 25 feet apart or in approximately 10 tree clusters at 100 to 150-foot spacing to lessen the potential for root grafting (a source of PL spread). Silvicultural prescriptions for sites having potential for growing POC would provide for the establishment of the species through natural or artificial regeneration and maintenance as a viable stand component through the current and future rotations.

11) Washing Project Equipment: Wash project equipment prior to beginning work in uninfested project areas, when leaving infested areas to work in uninfested areas, and when leaving the project area to minimize the transportation of infested soil to uninfested areas. Equipment includes maintenance and harvest equipment coming in contact with soils, and project vehicles, including trucks and crew vehicles, leaving surfaced roads or traveling on other roads deemed at risk for spreading disease. Project areas should be compartmentalized by road system in areas with mixed ownership (Federal and private). A road system with infested areas and noninfested areas would be considered infested. Washing areas should be placed at optimum locations for minimizing spread, such as at entry/exit points of the road system with Federal control. Washing should take place as close as possible to infested sites. Ideally, equipment should not travel for any substantial distance prior to being washed unless being transported on paved roads. Equipment moving into uninfested areas may be washed miles away as long as they do not travel through infested areas to reach their destination. Effectiveness testing indicates large reductions in inoculum by washing. Additional information about washing, and suggested parameters for washing stations, can be found in Appendix 2 and 3 of the BLM "Port-Orford-Cedar Management Guidelines," which can be found in Appendix 1 of this SEIS.

12) Logging Systems: Use non-ground-based logging systems (full suspension or helicopter).

13) Spacing Objectives for Port-Orford-Cedar Thinning: POC spacing objectives during thinning projects (commercial or precommercial) should be to create discontinuous POC populations across the management unit.

14) Non-Port-Orford-Cedar Special Forest Products: No special forest products permits, including firewood permits, would be issued in the wet season where POC is present, unless administration shown above for POC boughs can be implemented. Educate the public on the risks associated with collecting in areas with POC.

Monitoring

The monitoring plan for this alternative is in Appendix 5.

Alternative 3 — Port-Orford-Cedar Cores and Buffers

This alternative contains the management elements of Alternative 2, and seeks to slow the spread of PL even more by adding additional protection for 32 currently uninfested 6th field watersheds having at least 100 acres of stands containing POC. Specific protection measures are prescribed for the POC stands within these watersheds (POC core areas), and somewhat different protection is prescribed for the remainder of these watersheds (POC buffers) to lessen the possibility of infection within the POC core.

The objectives of this alternative are to:

- Maintain POC on sites where the risk for infection is low;
- reduce the spread of root disease;
- attempt to reestablish POC in plant communities where it has been significantly reduced in numbers by root disease;
- prevent root disease from becoming established in disease-free subwatersheds.

General Direction

Except for the specific requirements for the POC cores and buffers described below, and minor differences in the monitoring plan shown in Appendix 5, all direction for Alternative 2 applies to this alternative.

Management of Port-Orford-Cedar Cores

Analysis of Federal lands with greater than 100 acres in stands that include POC shows that there are currently 32 6th field watersheds in Oregon uninfested with PL (see Map 1). These stands occur in Matrix as well as various reserve land allocations. Uninfested POC stands within these watersheds (about 34,400 acres) would be referred to as POC cores (see Table 2-2). POC cores are not necessarily contiguous acres. POC cores are represented in red on Map 1 using existing geographic information system stand mapping. Actual POC core boundaries would depend on where POC occurs on the ground. Stands with any level of POC are included. Watersheds no longer qualify for POC cores and buffers if 5 percent or more of the POC core area becomes infested with PL.

The following measures apply to POC cores:

1) Minimize Entry: Administratively controllable entry into POC cores would be minimized. For example, product collection or other special use permits would not be issued in these areas.

2) Transportation Analysis: A transportation analysis would be conducted to determine road needs for the POC cores. Management objectives should minimize the road system within the POC core, which could result in decommissioning parts of the existing road system. New (discretionary) road construction would not be permitted.

3) No Vehicles: To the extent road access is controlled by the Agencies, all vehicular traffic would be excluded, with the exception of administrative access. Off-highway vehicle use would not be permitted.

4) No Timber Harvest: Timber harvest, including salvage, would be prohibited, unless a stand-replacing event results in the area no longer qualifying as a POC core area. Stand treatments not involving timber harvest would be permitted.

Table 2-2.—*Port-Orford-cedar disease-free 6th field watersheds* [1]

Subwatershed [6th field] number	Subwatershed name	Administrative unit [2]	Core Matrix/ Riparian Reserve/ Adaptive Management Area acres	Core reserve acres [3, 4]	Port-Orford-cedar buffer acres	Total subwatershed acres [5]	% Federal ownership
171003100103	Taylor Creek	M	106	305	15,484	17,649	90
171003100105	Rogue River/Lower Hellgate	M	0	285	10,954	12,847	87
171003100401	Rogue River/Whiskey Creek	M	0	779	13,266	15,090	93
171003100406	Rogue River/Missouri Creek	M	6	2,000	11,485	14,850	91
171003110101	Upper East Fork Illinois River	S	0	1,775	8,537	10,312	100
171003110404	Rough and Ready Creek	S	34	2,013	21,260	23,852	98
171003110501	Upper Deer Creek	M	6	1,902	9,319	14,347	88
171003110602	Josephine Creek	S	236	4,627	22,867	27,773	100
171003110602	Sixmile Creek	S	136	577	13,326	14,319	98
171003110604	Baker Creek	S	0	440	20,388	21,302	98
171003110702	Lower Briggs Creek	S	178	1,773	15,276	19,104	90
171003110801	Florence Creek	S	0	144	11,739	11,883	100
171003110802	Klondike Creek	S	0	537	9,491	10,028	100
171003110804	Middle Illinois River	S	0	416	21,857	22,273	100
171003110901	Upper Silver Creek	S	676	395	26,294	27,484	100
171003111003	North Fork Indigo Creek	S	0	361	18,905	19,287	100
171003120103	Box Canyon Creek	S	0	146	9,406	9,552	100
171003120104	Tin Cup Creek	S	0	1,062	16,690	17,752	100
171003120105	Chetco River/Sluice Creek	S	0	488	13,991	14,479	100
171003120106	Boulder Creek	S	0	987	12,987	13,974	100
171003120108	South Fork Chetco River	S	1	147	27,743	28,811	97
180101010101	Chrome Creek [Upper North Fork Smith River]	S	0	2,861	21,650	24,511	100
180101101102	Baldface Creek	S	0	3,355	16,441	19,796	100
171003021002	Willis Vandine	R	287	0	2,384	28,321	9
171003021201	Mt. Shep/Thompson	R	137	0	8,038	18,586	44
171003021204	Shields	R	5	105	6,773	25,561	27
171003090604	Slate Creek	M	917	0	15,322	28,409	57
171003100101	Rogue River/Upper Hellgate	M	359	45	17,742	32,936	55
171003110405	Lower West Fork Illinois River	M	354	137	3,285	12,161	30
171003110502	Middle Deer Creek	M	0	106	7,799	18,390	43
171003110504	Lower Deer Creek	M	479	94	10,529	23,224	48
171003110601	Illinois River/Kerby	M	429	101	7,611	18,279	45
171003110701	Upper Briggs Creek	S	1,488	647	22,044	24,626	98
Total Roseburg		R	429	105	17,195	72,468	24
Total Medford		M	2,656	5,754	122,796	208,182	63
Total Siskiyou		S	2,749	22,750	330,897	361,121	99
Grand total			5,833	28,609	470,886	641,770	79

[1] Watersheds serve as the basis for POC core and buffer areas under Alterntiave 3; acres reflect stands assumed lost in Biscuit Fire [see Map 2].
[2] Predominant administrative unit: M=Medford BLM District; R=Roseburg BLM District; S=Siskiyou National Forest.
[3] Data is approximate, based on current Agency mapping analyzed with GIS systems. Actual size of core and buffer areas may vary based on actual field conditions.
[4] Reserves include Late-Successional Reserves, Congressional Reserves, and Administratively Withdrawn.
[5] Includes private acres.

5) Water Sources: To the extent consistent with firefighter safety and water availability, wildfire suppression within the POC cores would utilize water from within the uninfested watershed. Water sources would be mapped.

6) Trails: New trails would not be built in POC cores. Whenever practicable, move existing trails so they do not pass through POC cores.

7) Roadside Sanitation: Remove or kill all POC less than 10 inches dbh (diameter at breast height) along both sides of the road. Recommended minimum width is 25 feet above the road or to the top of the cutbank, and 25 to 50 feet below the road. Roads that are open year-round generally pose the highest risk and would benefit most from sanitation treatment. Maintenance would be essential to retain benefits. POC should be re-treated as soon as possible after they reach a height of 6 inches above ground level.

8) Eradication: All areas within the POC cores that become infested with PL in the future should be considered for eradication treatments. Where practicable, the objective is to reduce and eventually eliminate PL from POC cores. Eradication treatments could be a source of commodities.

Management of Port-Orford-Cedar Buffers

To reduce the likelihood of introducing root disease within POC cores, the remainder of the 6^{th} field watershed containing POC cores would be managed as a POC buffer. This includes all land allocations. Management within the POC buffers would include actions that reduce the possibility of introducing PL into the POC cores, as described below. There are 32 POC buffers in the analysis area, ranging from 2,384 acres to 27,743 acres. On the enclosed map (see Map 1), Federal lands within the buffers are shown in four colors depending on their land use allocation.

The following measures apply to POC buffers:

1) Transportation Analysis: A transportation analysis would determine road needs for the POC buffers. Management objectives should minimize the road system available for public use, particularly for vehicle traffic, both within and entering the 6^{th} field watershed. This may include, but does not necessarily mandate, reduction in the total number of road miles. Emphasis would be on limiting public road use to the dry season with seasonal closures of selected roads.

2) Water Sources: Planned management actions (outside of wildfire suppression) would use water from within the POC core or buffer, or from sources known to be uninfested. To the extent consistent with firefighter safety and water availability, wildfire suppression within the POC buffer would utilize water from uninfested sources when possible.

Monitoring

The monitoring plan for this alternative is in Appendix 5.

Alternative 4 — Passive Project Management with Accelerated Resistance Breeding

This alternative would remove current site-specific measures used to control the root disease spread, but would accelerate the resistance breeding program. The resistance breeding program is designed to supply seedlings to replace (at the same site or elsewhere) POC killed by the disease. Quickly replacing dead POC in natural stands with resistant POC seedlings, and planting microsites at less risk of exposure to PO, would be emphasized.

The objectives of this alternative are to:

- Maintain POC on sites where the risk for infection is low;
- permit the disease to run its course in high risk areas;
- attempt to quickly reestablish POC in plant communities where it has been significantly reduced in numbers by root disease.

General Direction

Except when coincident with other management activities or programs, or when there is potential to spread the root disease from infested federally-administered lands to adjacent uninfested private lands, active Federal forest efforts to limit the spread of the pathogen would be discontinued. An example of when compatible treatments would continue would be when washing vehicles for the control of noxious weeds.

Genetics. The ongoing interagency breeding program at the FS Dorena Genetic Resource Center located at Cottage Grove, Oregon, would be intensified. Operational containerized seed orchards, organized into previously identified **breeding zones**, would be developed at a faster pace and maintained to produce resistant seed. Screening and breeding activities to increase the level and diversity of resistance available would accelerate for those zones of concern. Any forms of partial resistance are likely to need several cycles of selection and breeding to be of most benefit—with POC, this can be accomplished much faster than with most other forest tree species. Further research would be done to uncover more information on the array and number of resistance mechanisms available, and their underlying basis. For testing and reforestation purposes and for orchard development, an adequate production flow of rooted cuttings would also be assured.

Resistant stock would be developed and made available for all POC reforestation and restoration projects. About 50 to 75 percent of resistant seedlings have survived during 10 years of exposure to the pathogen, compared to 0 to 5 percent for nonresistant stock (field trials are under way).

The existing interagency resistance breeding program would be continued as described in a POC interagency agreement between the FS and BLM. The objectives of this agreement are to (1) select and evaluate families for resistance and develop durable resistance to PL while maintaining broad genetic diversity within the species, and (2) produce seed genetically resistant to PL for deployment throughout the range of POC where PL is present. The POC resistance breeding program would continue as follows:

∉ Develop resistant seed for breeding zones (breeding blocks plus elevation zones) based upon management needs within the range of POC;

∉ the three BLM Districts and the Siskiyou NF will develop a POC strategic deployment strategy for the planting of resistant POC stock, and include consideration for state and private lands (see Appendix 6);

∉ continue efforts to inform the public about the availability and use of resistant seed;

∉ find ways to provide resistant seed to non-Federal landowners; and

∉ monitor the operational performance of resistant plantings.

Collect and maintain between 50,000 and 100,000 resistant seeds (about 0.5 pound) for each POC breeding zone in organized conservation seedbanks. This seed would be reserved exclusively for reforesting areas after the occurrence of stand-replacement events such as large-scale wildfires. Where possible, resistant POC seedlings would be planted in such locales, with the goal to reintroduce POC to all pre-fire locations.

Snag Retention. Emphasize the retention of POC snags in Riparian Reserves because they are resistant to decay and the resultant down logs can provide durable structural components for both aquatic and terrestrial ecosystems. Retention numbers should consider that few additional large POC snags are likely to become available in the near future in infested areas because of the current mortality and presence of PL. This direction is particularly applicable to plant associations on utramafic soils and other locations where POC can be some of the largest and most abundant trees.

The stabilizing effects and habitat contributions of large POC woody material and its root mass in stream channels has often been described as the primary geomorphic control for soil movement in certain stream systems. Dead POC can provide in-channel structure, a source of nutrients, and a substrate for wood-associated aquatic insects. This allows for maintenance of the stream channel over time and retains anadromous and resident fish habitat.

Monitoring

The monitoring plan for this alternative is in Appendix 5.

Alternative 5 — Passive Project Management with Reduced Resistance Breeding

This alternative would remove current site-specific measures used to control the root disease spread and discontinue the resistance breeding program. All current management activities described in Alternative 1 would be discontinued except for the operational POC seed production orchards. Seedlings from existing resistant seed orchard trees would continue to be used to reforest areas of mortality occurring in the same breeding zone, but resistant seed for other breeding zones would not be developed.

The objectives of this alternative are to:

- Maintain POC on sites where the risk for infection is low;
- permit the disease to run its course in high risk areas.

General Direction

Except when coincident with other management activities or programs, or when there is potential to spread the root disease from infested federally-administered lands to adjacent uninfested private lands, active Federal forest efforts to limit the spread of the pathogen would be discontinued. An example of when compatible treatments would continue would be when washing vehicles for the control of noxious weeds.

Snag Retention. Emphasize the retention of POC snags in Riparian Reserves because they are resistant to decay and the resultant down logs can provide durable structural components for both aquatic and terrestrial ecosystems. Retention numbers should consider that few additional large POC snags are likely to become available in the near future in infested areas because of the current mortality and presence of PL. This direction is particularly applicable to plant associations on utramafic soils and other locations where POC can be some of the largest and most abundant trees.

The stabilizing effects and habitat contributions of large POC woody material and its root mass in stream channels has often been described as the primary geomorphic control for soil movement in certain stream systems. Dead POC can provide in-channel structure, a source of nutrients, and a substrate for wood-associated aquatic insects. This allows for maintenance of the stream channel over time and retains anadromous and resident fish habitat.

Monitoring

The monitoring plan for this alternative is in Appendix 5.

Alternatives Considered But Eliminated From Detailed Study

An EIS must rigorously explore and objectively evaluate all reasonable alternatives. The range of alternatives is limited by the requirement to fulfill the Purpose and Need to which the Agencies are responding in proposing the alternatives.

Many of the alternatives considered by the interdisciplinary team were eliminated from detailed study in attempts to find reasonable alternatives that would fulfill the underlying Need for the Proposed Action and the Purpose of this SEIS. The Need, as described in Chapter 1, is

> . . . the need for maintenance of POC as an ecologically and economically significant species on BLM and NF lands. POC plays a key role in the forest ecosystem because it serves as a component of many habitats and plant communities, provides culturally significant products for Tribes, and provides unique forest products.

This includes purposes to reduce disease introductions, slow the spread of the disease where present, and/or mitigate the occurrence of the disease on POC, to the degree such treatments are needed and cost-effective. The Agencies also must continue to meet their multiple-use mandates including providing access to products, public use, and fire suppression. Since the progression of the root disease over time is not predicted to vary widely between “no specific management” and “intensive POC management,” the interdisciplinary team chose to include a relatively wide range of alternatives for consideration in detail to ensure a reasonable range of resource effects relative to each issue. Alternatives were more likely to be eliminated from detailed study because they were too much like other alternatives, not because they did not meet the Purpose and Need.

Among potential alternatives considered were various strategies proposed by the public during the scoping process, as well as some strategies proposed by Agency staff. Some proposals reflected belief the disease would run its course and a combination of natural resistance and tree placement would preclude loss of all POC. Alternatives 4 and 5 best respond to these types of comments. Some proposals suggested prevention of new infections by prohibiting road access, harvest, and other management activities. These proposals are addressed by Alternative 3. Many proposals suggested that application of various control measures the Agencies were already implementing, along with careful monitoring and development of additional strategies, would allow for forest use, products, and POC protection. These comments are addressed by Alternatives 1 and 2. The interdisciplinary team appreciated the number of knowledgeable comments received during scoping. Many of the issues addressed in Chapter 3&4, as well as elements of the alternatives, came directly from scoping.

More Proactively Harvest Within Port-Orford-Cedar Stands

This alternative would reduce the spread of the disease by more actively thinning POC stands to reduce root contact between trees, cutting trees rooted into infested streams, and removing trees immediately upslope from riparian areas where POC serves a key function. This alternative would also actively salvage dead cedar in all land allocations where quantities exceed those required to meet to other management objectives.

This alternative was not analyzed in detail for two reasons. First, it is a variation on the No-Action Alternative that encourages or permits such treatments where site-specific analysis indicates it would benefit aquatic resources. Salvaging dead cedar is permitted in all alternatives, and can already be accelerated under existing guidelines. Second, an across-the-board increase in POC thinning and streamside sanitation would not meet the need for maintenance of POC as an ecologically significant species, because it would remove trees in important riparian and stream habitats regardless of risk.

Retain Most Disease Control Techniques, Particularly in High Public Use Areas, But Don’t Close Roads

This alternative would manage the spread of root disease by application of the full range of management techniques except closing roads. Roads would remain open for recreation, extraction, and other forest use. This is essentially a variation on other alternatives. Alternatives 1 and 2, and to a large extent Alternative 3, provide a menu of treatments to be applied based on site-specific conditions and disease-control needs. Managers can choose to close roads or apply other measures. The discussions of effects in Chapter 3&4, particularly the effects in the pathology section, address the specific standards and guidelines, land use, and management practices that most affect POC root disease spread. Managers can make that balance to the extent other techniques adequately control root disease spread and as public use favors keeping roads open.

Retain All Port-Orford-Cedar Old-Growth Stands and Large Trees

This alternative would prohibit harvest of large POC and old-growth stands of POC. It would help address the concerns that: Larger trees are killed at higher percentage and take longer to replace; ecosystem function and persistence in the ecosystem continues after POC die; and because of the root disease, old-growth POC would likely not become well distributed on the entire 80 percent of the Federal forests managed as reserves. However, this alternative is very similar to Alternatives 1, 2, and 3, in that (1) about 80 percent of the landscape is in reserves that preclude old-growth harvest, and (2) the percent of POC acreage in reserves may exceed 90 percent because POC is a riparian species over much of the eastern part of its range. This alternative is also similar to other alternatives in that the amount of old-growth or large POC tree harvest taking place is extremely limited. However, the exclusion of all harvest would not meet the Need of supplying wood for specialty products, and the retention of additional trees outside of riparian and other reserves would be of limited value because POC is used by terrestrial wildlife at a lower rate than other tree species.

Close Roads and Prohibit Management Activities in Uninfested Watersheds and Small Subwatersheds

This alternative would seek to limit new infection areas by stopping disease spread associated with roads and harvest equipment. Road use and timber harvest have been shown to be significant avenues of disease spread. Roads are the primary avenue for disease spread between watersheds. Such a strategy would reduce, but likely not eliminate, the incidence of new infections in these watersheds. The alternative would not preclude the movement of infections by hunters, hikers, bough cutters, elk, and other vectors. This alternative is a variation of Alternative 3, but protects more watershed areas. It would not meet the Purpose and Need of avoiding unnecessary restrictions on public access, access to products, forest treatments, and fire-suppression activities.

Restore Old-Growth to its Historic Range

This alternative would prohibit harvest of any large trees and attempt to restore old-growth to presettlement levels. Resistant stock could be used. This alternative is not feasible because of uncontrollable aspects of the root disease, and the responsibility of the Agencies to provide for multiple-use. While devoting sufficient land, time, protection, seed, and seedlings to this single objective could provide substantial esthetic and ecological benefits, costs would be exorbitant and other multiple-use objectives would not be met. Such an alternative would require eradication of the disease at a large scale, which has not yet shown to be effective.

Provide For Restoration of Port-Orford-Cedar on Sites Impacted by *Phytophthora lateralis*

This alternative would examine different strategies for introducing resistant stock, include evaluation and success criteria, and describe changes in other management practices if resistant stock is not successful. This alternative is a variation of elements of several of the alternatives considered in detail. The resistance breeding program common to four of the alternatives as well as the seedling deployment strategy common to at least three alternatives includes monitoring and adaptive management. Overall monitoring requirements call for tracking disease spread and reconsidering the management direction as appropriate. Alternative 4 and 5 are identical, except for emphasis on resistance breeding; the expectations from that program are well described and contrasted with the effects of discontinuing the current breeding program. Alternatives 1, 2, and 3 rely on a mix of management strategies that would ensure minimizing root disease spread even if resistant stock does not meet expectations. No alternative, except Alternative 4, places full reliance on the resistance breeding program. Although the other alternatives assume that the long-term effects of the resistance breeding program will mitigate the loss of existing POC to disease, these benefits would not be realized in the near future. Hence, there are no specific provisions for relaxing management practices in favor of using resistant stock in those alternatives.

Plant Port-Orford-Cedar In Other Suitable Habitats

The alternative would vigorously plant POC in wet, but upslope, aspen, and other low-risk areas suitable for its survival and growth. This alternative would help provide POC products for the future and potentially help maintain POC in some habitats. This alternative is generally a variation on other alternatives, particularly Alternative 2 which notes that

> . . . conservation should emphasize management on sites naturally at low risk for infection. In many forest types, management of POC can focus on sites where conditions make it likely to escape infection by PL, even if the pathogen has already been established nearby.

Use of this technique exclusively, however, would not meet the Purpose and Need since POC is an important component of streamside habitats and should be maintained.

Design Different Management Strategies for Different Parts of the Range to Address Different Conditions

This alternative recognizes there are significant differences in the location and ecological function of POC between the northwest part of the range (where POC grows away from streams, across the landscape) and the rest of the range (where POC is more of a riparian species). In the northwest part of the range, up to 80 percent of the POC grows away from streams and roads, and is therefore not at risk from these two primary infection sources. In other parts of the range, particularly on the ultramafic soils, POC can be primarily limited to Riparian Reserves, and therefore can be put at risk by activities that put the pathogen in the streams. This alternative would prescribe different measures for these different parts of the range. This alternative is essentially a variation of Alternative 2, because the application of the risk key in Alternative 2 would result already in the variable treatments suggested by this alternative.

Intensively Evaluate Individual Plant Association Group (PAG) Sites and Implement PAG-Specific Management Criteria

This alternative would identify representative samples for each of the 90 PAGs that are distributed across the range of POC in which POC is prominent. Close examinations of POC ecological functions and subpopulation characteristics would be performed, including determining genotypic differences using allozyme studies, DNA marker techniques, and common-garden study plots. Based upon PAG-specific data, specific management regimes would be conceived and desired treatments implemented. Individual management criteria would be applied to each site, including collecting and retaining seed from representative PAG sites in every breeding block. This alternative is not considered in detail because analysis has determined that PL will not completely eliminate POC from any given PAG, nor will it eliminate significant genetic variation, so such intensive scrutiny and management are not warranted. Such an alternative is not necessary to meet the Need and therefore would not meet the cost-effectiveness test in the Purpose.

Increase Port-Orford-Cedar by Encouraging Planting On Private Lands

This alternative would continue development of resistant POC in quantities sufficient to meet private land needs. This alternative would have the benefit of providing POC products and potentially meeting certain ecosystem and habitat needs. This alternative is a variation of Alternatives 1, 2, 3, and 4 that specifically identify a goal of supplying resistant seedlings to private and state lands. It is particularly similar to Alternative 4, which emphasizes the resistance breeding program to the exclusion of other proactive forms of POC management.

Impose Stronger Protections

This alternative would impose stronger protections for POC throughout their entire natural range by:

1) Withdrawing all uninfested areas from mineral entry;
2) banning new road building and road reconstruction;
3) closing Level 1 and 2 roads and trails in, or leading into, uninfested watersheds;
4) prioritizing road closure over the practice of "sanitation" logging;
5) prohibiting motorized vehicles in all inventoried roadless areas;
6) prohibiting motorized vehicles in landscapes affected by the Biscuit Fire, including the watersheds of Rough & Ready, Rancherie, Baldface, and Fall and Baker Creeks; and
7) evaluating the benefits of wilderness protection for roadless areas to prevent/ reduce the spread of PL.

Aspects of this alternative are included in other alternatives. Closing roads in uninfested watersheds to the extent allowed under current permits and laws is included in Alternative 3. Most motor vehicle use is already prohibited in inventoried roadless areas. Other elements of this alternative would not meet the Purpose and Need of providing access to the forest for public use and extraction of products. This is particularly acute within the Biscuit Fire area, where salvage harvest and restoration treatments are being analyzed. Closing all Level 1 and 2 roads, and withdrawing additional lands from mineral entry, would also not meet the Need to provide public access and use, and access products.

Focus on Prevention Rather Than Mitigation or Control

This alternative would try to eliminate all new infections by eliminating management activities and most other access into uninfested areas of any size. This alternative would not meet the Need of providing POC products, or of allowing the Agencies to continue to meet their multiple-use mandates for public use and access, fire suppression, and so forth.

Limit Risky Activities Such as Bough Harvest to the Matrix

This alternative would restrict bough cutting to the Matrix to prevent bough-cutting related infections from about 80 percent of the Federal lands. This alternative is a variation of a standard and guideline in Alternatives 2 and 3 which severely restricts all bough cutting. Further, such a limitation would probably not meet the Purpose and Need because illegal bough cutting and accidental cutting in reserves would be difficult to enforce if bough cutting were allowed nearby in the Matrix. This cutting in the Matrix would continue to contribute significantly to the spread of disease.

Broaden Risk Analysis to Include Road Maintenance, Road Use, Recreation Use, and Other Broad-Scale Activities Not Necessarily Subject to Project-Level or NEPA Analysis

This alternative would require routine forest use and management activities to be examined for the effect on root disease spread, and mitigation or control measures applied as appropriate. This alternative is a variation on other alternatives considered in detail. Alternatives 1, 2, and 3 already have such requirements. For Alternative 1, as described in Appendix 2, road maintenance techniques and road-side sanitation are examples of activities triggered by road use and location, not by specific projects. Water sources are mapped, roads are closed, trails are moved, the public is informed about how to avoid spreading the disease, roads crossing streams are removed, road maintenance and other crew regularly clean vehicles and are aware of the location of infested areas, and integrated planning takes place. For Alternative 2 and 3, there is a specific requirement to apply the risk key to such activities.

Eliminate Timber Harvest in Port-Orford-Cedar Areas

This alternative would prohibit timber harvest in POC stands thereby reducing the likelihood of carrying the pathogen into uninfested stands, or out of infested stands. This approach is applied to POC stands in currently uninfested watersheds in Alternative 3. Application of this approach to the entire range would not meet the Need for making POC products available, or meet the Purpose of allowing the Agencies to continue to meet other multiple-use mandates including the extraction of a wide range of products. On lands managed for regularly scheduled timber harvest, POC typically makes up no more than 5 to 10 percent of the stands. Even if the Agencies harvested no POC, the prohibition against harvesting in these stands would have a substantial effect on other harvest objectives. This alternative also would not meet the Need for the maintenance of POC. While such an emphasis would undoubtedly reduce the spread rate, disease spread would continue via other human vectors. Other human vectors besides logging, for example, are implicated in all but one of the five or six longest distance spreads.

Prohibit Logging During the Wet Season When the Likelihood of Disease Spread is Highest

This alternative would limit the likelihood of spreading POC root disease by limiting timber harvest to dry periods when the likelihood of moving infested soil is lowest. This treatment is already included as a management practice available under Alternative 2, reading in part

> . . . schedule projects during the dry season or . . .

Second, such scheduling is already practiced to the extent possible in order to protect soils, roads, and streams, particularly for ground-based skidding. To place further restrictions than these two, when coupled with existing seasonal restrictions for nesting wildlife and other purposes, would not meet the Need for continuing to provide products. It would also not meet the Purpose that control measures be cost-effective. Limiting harvest while other uses continue during the wet season could reduce, but not nearly eliminate, disease spread.

Reverse *Phytophthora lateralis* Infestations and Eliminate it from the Landscape

This alternative would eliminate the root disease from the range of POC by temporarily (up to 10 years) removing all POC in, around, and for up to 200 meters downstream of infested areas and keep them free of POC for up to 7 years for the pathogen to die out of the soil. This alternative is not feasible or practical for several reasons. First, the pathogen currently infests an estimated 22,000 to 32,000 acres in Oregon, an acreage (plus surrounding buffers) that would be prohibitively expensive if not impossible to treat. Second, the impact of killing these trees all at once, particularly downstream from the infestations, could have a worse effect than the gradual advance of the disease. Third, while eradication success is promising enough to try in isolated cases such as in POC cores (Alternative 3), limited Agency experience with eradication treatments has shown that treatments are not always successful. The pathogen can persist in the soil for many years. In very limited trials so far, even prescribed fire has, to date, not been uniformly demonstrated to kill the pathogen. Fourth, even if eradication were typically more successful, some infestations would escape the treatment. For example, although research shows infections to be typically located within 200 yards of an upstream infection source, anecdotal evidence indicates the disease can travel much farther. Finally, the disease would not be removed from private lands, so there would continue to be an infection source.

Treatments suggested by this alternative are already included in Alternatives 2 and 3 to some extent. Eradication treatment is one of the management options, and will be used where limited infections exist. An eradication treatment for a small, isolated infestation is being done on the Shasta-Trinity NF, for example. These alternatives call for an increase in eradication once this technique proves successful.

Manage According to Stand-Specific Risk Assessment Methods

This alternative would employ methodologies for identifying elements of risk (value, hazard, exposure, and susceptibility), and a resulting range of possible management objectives and strategies to deploy on a landscape scale (Jimerson et al., *unpublished*; Atzet and Rose, *in press*). This alternative is essentially a variation of Alternatives 2 and 3, because these alternatives acknowledge inherent POC values and then, embedded as an integral component of the risk key, identify relative hazard based upon exposure and susceptibility on a project basis.

Close Roads and Eliminate Mining in Wilderness to Exclude *Phytophthora lateralis*

This alternative would administratively, or by purchase, eliminate existing mining claims in the Kalmiopsis (and any other) Wilderness Area and restore access roads. The alternative would not meet the element of the Purpose to continue to meet multiple-use needs by providing access to products. Mining is an important and legitimate use of public lands, providing raw materials for a variety of industrial uses. Congress considered these uses so important that the 1964 "Wilderness Act" had a grace period for filing and beginning operations on mining claims in wilderness, and such claims remain valid as long as they are maintained. Closing such claims could constitute a "taking," and would require purchase by the Federal government. Also, such a restriction may not have the desired effect, because the sources of infestations near mining activity are simply not well known.

Finally, there are other measures that can be taken under the standards and guidelines of Alternatives 1, 2, and 3. On NFs, operations of any size, and even most prospecting, requires a plan of operation to be filed with the local administrative unit if the proposed activity would likely cause significant disturbance of surface resources. Applications typically trigger an EA or other NEPA analysis. Depending upon the risk, the Agency is required to provide reasonable terms and conditions for the operation. In this case, requirements to follow the same POC management practices used on other Agency activities would be binding on the claimant. Infection risk from mine operations are currently reduced because the Kalmiopsis claim owner has been using helicopters to bring in equipment, and travels the road via horseback.

The BLM rules are similar to those described above.

Include Disease Control Provisions for Sudden Oak Death

This alternative would provide standards and guidelines for the prevention and eradication of Sudden Oak Death. At this time, scientists and land managers have no way of predicting the movement of Sudden Oak Death, *Phytophthora ramorum*, across the range of POC in southwestern Oregon or northern California. In California, the pathogen is present and causes disease in many plant species in coastal areas, with the disease being most abundant and severe in forest types with a significant component of tanoak. Since the disease was discovered and identified in 2000, it has increased dramatically in California and now extends to within 125 miles of the Oregon border. Presently, the disease is not known to occur in Del Norte County or northern Humboldt County, California. In Oregon, the disease has been found at 22 locations within a 9 square-mile area near Brookings, now regulated by Oregon Department of Agriculture. Infesting not more than 55 acres, all of these areas have been cut and burned in an effort to eradicate all populations of the pathogen. There has also been recent discoveries of Sudden Oak Death in nursery stock near Gresham, Oregon (eradication is under way). None of the Oregon locations are within the natural range of POC.

Research is underway in California to describe factors that affect spread of the disease across the landscape, but at present these are poorly understood. Therefore, spread of the disease cannot be predicted. Sudden Oak Death has not been analyzed as part of POC-SEIS because too little is known about the disease spread mechanisms and pathology to design control measures. *P. ramorum* has only been clearly known and studied for a few years. Too little is known about the disease for development of an impacts analysis and disease management evaluation.

PL is a root disease, but *P. ramorum* attacks plant stem and leaf tissues. While the major host species for *P. ramorum* and PL, tanoak and POC respectively, are both located in southwestern Oregon and northern California, there are obvious host differences in the species range, habitats occupied, and life history that suggest a different disease mechanism is operating. POC is generally restricted to sites near groundwater; moisture regime strongly influences community development and plant associations within the range of POC. Tanoak is not strongly dependent on a consistent supply of soil moisture and is usually found on sites that are much drier than those for POC. The range of tanoak extends much further south into the hotter, drier climates of the central California coast range (and even into the Sierras) than does POC. In California, there is a correlation between the spread of *P. ramorum* into tanoak and its association with high population levels of California laurel (*Unbellularia californica*). There is no known connection between high population levels of California laurel tree, sometimes called Oregon myrtle, and POC. Additionally, *P. ramorum* has been found to kill or injure a wide variety of host species, while PL is only known in two host species (Sudden Oak Death Symposium, Monterey, California [February 2003]).

The differences between *P. ramorum* and PL and their host species are enough to suggest that the difference in environmental affects resulting from each disease and the difference in disease management practices would be substantial.

Close More Roads within Federal Lands

This alternative would close roads in uninfested Federal lands, especially those also going through nearby infested private lands. This alternative was not considered in detail because there are provisions within other alternatives to consider closing roads where needed and appropriate. But in particular, a substantial increase in road closures is not possible in many cases, at least not without purchasing existing private interests to those roads.

Bureau of Land Management-administered lands. The BLM entered into hundreds of Reciprocal Right-of-Way Agreements in western Oregon to gain access for forest management activities on the "checkerboard" lands that the BLM is responsible for managing under the "O&C Act" of August 28, 1937. In the early 1950s, BLM published the O&C Logging Road Right-of-Way regulations, now codified as 43 CFR 2812, initiating the development of Reciprocal Right-of-Way Agreements with most of the private timberland owners within the O&C area of western Oregon. A Reciprocal Rights-of-Way Agreement is a legal exchange of rights between the BLM and a private landowner, called a "permittee." The major benefit and objective of these agreements is the joint use and development of a single, forest road system that serves the needs of the BLM and the intermingled private timberland owner. This arrangement eliminates a potentially duplicative road system and provides guaranteed access for prospective bidders of BLM timber sales. BLM and a permittee share costs in the construction and maintenance of the road network.

To gain access to their respective lands, BLM and the other party have Reciprocal Right-of-

Way Agreements to use existing roads and construct new roads across each other's lands. Typically, these agreements are granted in perpetuity to assure long-term access for both parties. The lands that each party can cross are specifically identified in the agreement by legal description and are recorded in the counties where the lands are located. The terms of the agreement are specific and apply to both parties equally. Each party has little discretion in not approving a new road location requested on that party's lands by the other party. In most of the agreements, the only reasons why a proposed road location can be rejected is: (1) the new road location does not constitute the most reasonable direct route; (2) the new road will substantially interfere with existing facilities; (3) the proposed road will cause excessive erosion; or (4) there is already an existing road suitable for the transportation of timber to market. Mitigation measures can be required for new construction, but only if they are to mitigate one of the reasons for rejecting a construction plat in the permit. Because of the reciprocal nature of these agreements, the terms and conditions generally cannot be amended or changed without the approval of both parties.

Reciprocal Rights-of-Way Agreements are considered as legally binding interests on the lands identified in the agreement. Responsibility of the parties for compliance with the environmental laws, including the "Endangered Species Act," have been tested in court and it has been affirmed that the BLM has limited discretion when roads are planned for construction on public lands by a permittee.

Reciprocal Rights-of-Way Agreements continue to operate as the primary means of obtaining access to intermingled BLM and private timberlands in western Oregon. It is estimated that nearly 80 percent of the public lands in western Oregon are encumbered by one or more agreements.

Although BLM roads are available for use by the public, they are not "public roads" as defined by State Statute ORS 386.010(2). BLM roads are considered "private government roads" and the Agency retains the authority to control activities on these roads including use by the general public.

In addition to Reciprocal Right-of-Way Agreements for roads, the Bureau has issued right-of-way reservations to the Bonneville Power Administration for utility corridors, pipeline rights-of-way, and numerous rights-of-way grants to private parties for utilities or to access home sites, as well as to numerous users of communication sites located on BLM-managed lands.

Forest Service-administered lands. The FS has the same or similar obligations. Several factors affect the level of discretion held by the FS relative to road use and control. Private road use rights are often held on NF System roads and the degree of control the agency may exercise is dictated by the terms of the document creating the private right. Some private use rights were retained by landowners who conveyed some of their lands to the FS but needed continued road access across the lands to reach other parcels they still owned. Other rights have been granted to private landowners under such authorities as the "Federal Land Policy and Management Act" and the "National Forest Roads and Trails Act." The FS shares ownership in entire road systems where cooperative road construction and use ("cost share") agreements have been entered into with large industrial timberland owners. Other authorities have authorized access, such as laws relating to mining on Federal lands. The FS has a statutory requirement to grant reasonable access across NF System lands to landowners within NF boundaries and many different types of access grants have been issued to comply with this mandate.

In general, rights possessed by non-FS entities on NF System roads allow for ingress and egress to private lands subject to traffic regulations, such as speed and weight limits, as well as responsibility for road maintenance commensurate with the use. There are many private use roads, such as private driveways, on which the FS exercises little discretion as to road standards or type of use since they are not open to the public.

Reservations, outstanding rights, and easement grants all constitute some form of non-Federal interest in the NF road and each road must be individually assessed to determine the extent of private and Federal rights of use and control.

Comparison of the Effects of the Alternatives

Disease Spread: Table 2-3 summarizes the disease infestation predictions for 100 years by "risk region" within the POC range. The risk regions differ in the way POC is distributed on the landscape relative to the primary disease spread avenues of water and roads. Put another way, the risk regions differ in the percentage of POC acres potentially affected by root disease in the future. Regardless of risk region, however, it is important to note that POC is not at risk of extirpation. Under the "no management" alternative, Alternative 5, disease infestation is predicted to cover 29 percent of all POC acres in 100 years, with no risk region exceeding 50 percent.

In the North Coast Risk Region (Coos Bay BLM District and Powers Ranger District on the Siskiyou NF), POC is well distributed across the landscape because of favorable moisture conditions. POC at high risk to infection because of proximity to streams and roads is approximately 20 percent of the total POC acreage. Because PL has been in this area more than 50 years, much of that time without active Agency disease-control measures, the disease has reached approximately 75 percent of these high risk sites, or 15 percent of the total POC acreage. Because spread is limited almost exclusively to high risk sites, this area is approaching disease saturation and the annual new infestation rate has substantially declined from previous decades.

In the Siskiyou risk region (Siskiyou NF and California) and Inland Siskiyou risk region (Roseburg and Medford BLM Districts), POC is more concentrated in riparian areas, raising the percent of POC acres in proximity to water and therefore at high risk to infestation. Higher road density and more checkerboard ownership pattern in the Inland Siskiyou risk region further increases the area at high risk, so the area of POC at high risk to infestation in these two risk regions is 40 and 60 percent, respectively. The root disease has not been in these areas as long, and the potential for rapid expansion of the disease acres is still high.

The standards and guidelines of each alternative affect the percentage of high risk sites that will become infested within the next 100 years. The predictions consider not only the provisions of the alternatives, but the location and context of federal lands within the larger POC landscape. In addition to the 272,000 acres of POC stands and 32,000 acres of infestation on federal lands in Oregon, there are over 50,000 acres of private lands with POC, and over 8,500 acres of infestation, often checkerboarded with Agency lands and being actively managed for timber production at all times of the year.

Table 2-3.—*100-year infestation prediction for Oregon by alternative*

Alternative	% of risk region high risk	Currently infested high-risk area [as % of risk region] [1]	Uninfected high-risk area [as % of risk region]	% of uninfested high-risk areas predicted to become infested [new] in 100 years [2]	Uninfested high-risk areas predicted to become infested [as % of risk region] [3]	Total [new and current] area to be infested in 100 years [as % of risk region]	Total [new and current] area to be infested in 100 years [in acres] [4]	Total [new and current] area to be infested in 100 years [as % of high-risk areas only]
North Coast Risk Region *[126,248 acres]*								
1	20	15	5	40	2	17	21,460	85
2	20	15	5	35	2	17	21,150	85
3	20	15	5	20	1	16	20,200	80
4 & 5	20	15	5	80	4	19	23,990	95
Siskiyou Risk Region *[116,374 acres]*								
1	40	9	31	40	12	21	24,900	52
2	40	9	31	35	11	20	23,100	50
3	40	9	31	20	6	15	17,690	37
4 & 5	40	9	31	80	25	34	39,330	85
Inland Siskiyou Risk Region *[29,341 acres]*								
1	60	9	51	40	20	29	8,630	48
2	60	9	51	35	18	27	7,880	45
3	60	9	51	20	10	19	5,630	32
4 & 5	60	9	51	80	41	50	14,670	83
Totals *[271,963 acres]*								
1				40		20	54,990	61
2				35		19	52,120	58
3				20		16	43,520	49
4 & 5				80		29	77,930	87

[1] All infestation is assumed to be within the high-risk areas.
[2] From Table 3&4-6.
[3] Previous two columns multiplied together.
[4] Mortality in infested areas is expected to be about 90%; table does not include replacement with resistant stock.

According to predictions detailed in the Pathology section of Chapter 3&4, the percentage of currently uninfested high risk areas that will become infested within the next 100 years is predicted to be 40, 35, 20, 80, and 80 percent for Alternatives 1, 2, 3, 4, and 5, respectively. Combining each of these predictions with the existing infestation level, and the portion of the area at high risk, results in the 100-year infestation percentage and acreage calculations shown in Table 2-3.

As shown in Table 2-3, the total area predicted to be infested at 100 years varies between 16 and 29 percent (from 12 percent today) depending upon alternative. The percent of "high risk" areas predicted to be infested in 100 years is also displayed because some effects, such as water temperature, are dependent more on the percent of PL infestation near streams, not the percent infestation on the entire landscape. The percent of high-risk riparian areas predicted to be infested in 100 years varies between 49 and 87 percent (from 36 percent today), depending upon the alternative. In both cases, the 100 year infestation percentage varies by risk region.

Differences in Risk Regions: In the North Coast risk region, most (75 percent) of the high risk areas are already infested. Since the alternatives primarily affect the percentage of high risk areas to become infested in the future, there is little difference in 100-year infestation percentage between the alternatives in this area (16 to 19 percent of the total area, 80 to 95 percent of high risk riparian areas). The similarities in this region between Alternatives 2, 3, 4, and 5 become more apparent upon examining the way they would be applied. The risk key in Alternative 2 and 3 requires project-specific management actions be applied when there is significant risk to uninfested POC in the area that, were they to become infested, would preclude the area from meeting land and resource management plan objectives. If there are few uninfested areas near by, or if those uninfested areas make no significant or unique contribution to ecological, tribal, or product use or function (use or function that is not equally met elsewhere or by other species), the key will not lead to the application of any project-specific management practices. This situation will likely occur more often than not in this risk region because most high risk areas are already infested, and because the terrestrial distribution of POC places 80 percent of its acres on low risk sites. The various effects sections in this SEIS (see Summary and Comparison of Effects, Table 2-4) support this generalization that few important functions will be at risk; they do not identify any significant adverse ecological effect from any of the alternatives in this region.

In the Siskiyou and Inland Siskiyou risk regions, the differences between alternatives are more pronounced. The 100-year infestation prediction varies from 15 to 34 percent in the Siskiyou risk region, and 19 to 50 percent in the Inland Siskiyou risk region, between the most and least protective alternatives. The alternatives also vary in the percent of high risk riparian areas infested, from 37 to 85 percent in the Siskiyou risk region and 32 to 83 percent in the Inland Siskiyou risk region, between the most and least protective alternatives. These percentages become particularly meaningful on ultramafic soils where POC is a prominent and often largest species present. On such soils, mortality can decrease stream shading, reduce fish survival, and have other measurable and predictable adverse effects.

Environmental Effects: The degree to which these POC mortality-related, or indirect, effects vary by alternative are summarized in Table 2-4 and described in detail in Chapter 3&4. It is important to note that these indirect effects, those resulting from POC mortality, do not all occur at once but are predicted to occur over the next 100 years as the disease advances into new areas.

There are also negative direct effects from the standards and guidelines themselves. The exclusion of timber harvest in the Core areas in Alterative 3, for example, would reduce scheduled harvest levels and reduce opportunities to treat fuels build-ups and diversify habitats. These direct effects for each alternative are also displayed in Table 2-4. In general across the range of alternatives, as the negative direct effects increase, the negative indirect effects decrease, and vice versa.

The various combinations of risk region, ultramafic soils, riparian areas, and POC prominence leads to a complex combination of affected environments and effects that generally

Table 2-4.—*Summary and comparison of the environmental consequences (effects) of the alternatives*

Resource/topic	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Pathology	54,990 acres [20%] infested in 100 years, 61% of high-risk riparian.	52,120 acres [19%] infested in 100 years, 58% of high-risk riparian.	43,520 acres [16%] infested in 100 years, 49% of high-risk riparian.	77,930 acres [29%] infested in 100 years, 87% of high-risk riparian.	77,930 acres [29%] infested in 100 years, 87% of high-risk riparian.
Ecology	Losses in species diversity and ecological function in one or more of 64 identified plant associations where POC is a major component [prominent]; more of a concern in ultramafic soils where POC is a major component; effect by alternative is proportional to acres infested; no plant association is eliminated.				
Botany	There are probably benefits to some rare plants proportional to decreased infestation acres. Also Alternatives 1, 2, and 3 road closures reduce noxious weed introductions and trampling. However, some rare plants benefit when nearby cedars die. No negative effects to threatened and endangered plants are identified.				
Water and Fisheries	Increased temperature in ultramafic areas results in coho salmon [ESA listed] and steelhead loss, with some effect in all alternatives, increasing towards Alternatives 4 and 5. Less than 5% of coho spawn in ultramafic streams, but temperature increases affect other parts of the system. Alternatives 1, 2 and 3 possible isolated mortality of salmonids from Clorox in fire suppression water drops.				
Wildlife	There are no species dependent upon POC, and no adverse effect on threatened and endangered species. Because pure stands are the exception, effects are minimal. In Alternative 3, late-successional forest-related wildlife benefits from reduced timber harvest, but reduced Late-Successional Reserve thinning could slightly reduce future habitat for these same species. Alternatives 1, 2, and 3 possible isolated mortality of aquatic species from Clorox in fire suppression water drops.				
Genetics	POC survival in all alternatives is sufficient to avoid loss of common genes and prevent large-scale population divergence.				
Resistance	Good major gene resistance and early fruiting of POC, plus very limited genetic variability in the pathogen, predicts successful development of durable resistant stock for replanting infested areas				
	Stock available in all breeding zones within 45 years.			Stock available in all breeding zones in 10 years.	Stock limited to current level [26% of breeding zones].
Fire and Fuels	Increased suppression and fuel treatment costs about 2 percent [Alternative 3 slightly more]. Alternative 3 would reduce access to 60,000 acres and prohibit timber harvest on 2,300 acres of wildland-urban interface.			No costs associated with POC disease control [possible fuels increase associated with mortality is insignificant].	
Recreation, Visual, Wilderness, and Wild and Scenic Rivers	Negative effects to some users if roads and areas closed; greatest in Alternative 3. Positive effects to visuals, wilderness, and wild and scenic river values [esthetic] of reduced mortality.			No restrictions on access. Esthetic impacts increased.	No restrictions on access. Esthetic impacts increased.
	Resistance breeding mitigates esthetic impacts over time, fastest in Alternative 4; not all areas in Alternative 5.				
Cultural Products for Tribes	Insignificant difference between alternatives because of modest levels used and access on other lands.				
Special Forest Products	Current level [4% of bough market], plus firewood and other collections.	Current level of bough collection, and <5% reduction of firewood and other collections.	Current level of bough collection, and slightly more reduction in firewood and other collections than Alternative 2.	Increase of bough harvest by 100 to 200 tons, plus slight increase in firewood and other collections from current levels.	
Timber Harvest	Increase in cost to purchasers of about $0.80/thousand board feet.				
			Decrease in PSQ approximately 0.7 million board feet and no thinning in 2,300 Late-Successional Reserve acres.		
Direct Costs	$860,000	$846,000	$881,000	$477,000	$93,000
Environmental Justice	Current level	Slight job decrease	Job decrease includes 8 timber jobs	Job increase of 6 related to bough collection	

Note: The planning area includes 1.5 million acres of Federal lands and 272,000 acres with some level of POC stocking, 32,000 of which is infested with root disease.

defies range-wide generalizations. In general, the effects (both positive and negative) listed on Table 2-4 are greatest in the Siskiyou and Inland Siskiyou where mortality differences between the alternatives are greatest, and lower in the North Coast risk region where differences between the alternatives are generally slight or nonexistant. The nature of each of the various effects, and the affected environment in which those effects occur, are described in more detail in Chapter 3&4.

Resistance Breeding: Alternatives 1, 2, 3, and 4 include some level of resistance breeding for all breeding zones, and Alternative 5 would only use resistance stock in the 26 percent of the breeding zones for which it has already been developed. There is an expectation that the resistance breeding program will mitigate at least some, and potentially many, of the adverse indirect effects in the long term, as POC killed by the disease are gradually replaced by planted resistant stock and their off-spring. Alternative 4, scheduled to have seed for all breeding zones within 10 years, will be able to begin this mitigation up to 35 years sooner in some zones than Alternatives 1, 2, and 3. Although there are long-term uncertainties in any resistance breeding program, the chance for durable resistance in POC is good because it appears to have major gene resistance, the disease itself has a very narrow genetic base indicating a low likelihood of it adapting to kill resistant trees, and POC begin to produce cones as early as age 5 which makes a rapid breeding program possible.

However, because uncertainties about Agency funding in Alternatives 1, 2, and 3 (which include language "per available funding"), and the long timeframes involved for planted POC to be large enough to substantially mitigate adverse effects of POC mortality, the expected benefits are generally not included in the effects summarized on Table 2-4. The level of benefit will depend on the success and application of the breeding program. Planting resistant stock can only reduce, not increase, negative effects displayed in the effects discussions. Fortunately, every dead tree need not be replaced by direct planting. POC begins fairly prolific seed production as early as age 5. Successful plantings of a few dozen resistant trees in an infested area should be sufficient to begin a cycle of natural regeneration of resistant or partially resistant stock with adequate genetic variability. In any event, however, significant reduction of the adverse indirect effects summarized in Table 2-4 will not begin to occur until resistant trees exceed 50 to 80 years of age, and will not occur at all in some breeding zones if the program is not funded.

Potential Mitigation Measures

The implementing regulations of NEPA, at CFR 1502.14(f) and CFR 1502.16(h), require identification of measures to mitigate adverse environmental impacts. It is important to note that the alternatives considered in this SEIS are themselves different levels of mitigation measures that apply to other forest management and use. All known measures to mitigate the spread of PL are included in one or more of the alternatives to the extent such measures would continue to meet the agencies multiple-use mandate. Even measures that have not been proven, such as eradication, are encouraged for trial and evaluation in one or more of the alternatives. The monitoring section specifies continued evaluation of various PL-reducing management techniques so management can best mitigate the spread of PL on future activities.

In Alternative 2, the definition of an "activity" with respect to the use of the risk key is purposely broad in order to force consideration of the full range of potential PL-spreading activities.

The resistance breeding program is another mitigation program, and one that can be used to mitigate adverse effects in sensitive habitats. Where POC losses occur near sensitive or listed wildlife, botanical, or fish species, opportunities to plant resistant stock will be identified and implemented as appropriate.

Mitigation for direct effects to other programs are included in the alternatives as well. For example, a provision for some level of bough harvesting in Alternatives 2 and 3 helps reduce the job losses attributable to bough harvest restrictions. This will help mitigate adverse effects identified in the Environmental Justice and Civil Rights sections.

Measures that would be somewhat more effective than any of the alternatives at slowing the spread of PL include more road closures; indeed, large area closures. Given the analysis of the likely spread of the disease, and the need for other uses of our public lands, consideration of additional closures would not meet the Need. This topic is dealt with in the Alternatives Considered but Eliminated from Detailed Study section.

Potential and likely adverse effects identified in Chapter 3&4 are listed in Table 2-5, along with possible mitigation measures for each. The mitigation option of selecting a different alternative is also a choice, and is not included in the table.

Table 2-5.—*Identified adverse environmental effects and possible mitigation measures*

Resource Elements	Adverse Effect	Possible Mitigation
Pathology	Disease spread and related effects to private, other units, long-distance spread; mostly in Alternatives 4 and 5.	1] Clarify "reduced spread" objective of Alternatives 4 and 5, by adding "avoid disease export" provision from Alternative 2. 2] Increase public education in offsite areas regarding the risk of receiving disease from unfamiliar equipment. 3] Encourage State to enact POC root disease measures on non-Federal lands. 4] Develop disease resistant seedlings for use on private lands.
	Increase in POC infestations and mortality on Agency lands.	Function, not mortality, is the effect; mitigation for function loss discussed under other headings.
Ecology	POC mortality-caused reduction in plant diversity; greatest in Alternatives 4 and 5.	1] Improve risk-mapping of POC to improve efficiency and effectiveness of disease-reduction measures. 2] Plant disease-resistant stock or alternate species in affected areas.
Botany	Possible POC mortality-related negative effects to some rare species; greatest in Alternatives 4 and 5.	1] Plant disease-resistant stock or alternative species in affected areas. 2] Identify species and sites most affected by POC mortality, and protect or plant those sites specifically.
Water	Streams in ultramafic soils, POC mortality-related increase instream temperatures, particularly in Alternatives 4 and 5.	1] Plant disease-resistant stock or alternate species in affected areas. 2] Apply the uninfested watershed provisions of Alternative 3 to specific watersheds.
Fisheries	Streams in ultramafic soils, POC mortality-related negative effect on coho [ESA listed] in upper Illinois River Watershed, and on steelhead; greatest in Alternatives 4 and 5.	1] Plant disease-resistant stock or alternate species in affected areas. 2] Apply the uninfested watershed provisions of Alternative 3 to ultramafic subwatersheds in the upper Illinois River Watershed.
Wildlife	POC mortality-related slight general long-term effect on snag, down wood, and riparian-dependent species not detectable at the landscape scale; greatest with Alternatives 4 and 5.	1] Plant disease-resistant stock or alternate species in affected areas.
	Alternative 3 prohibition on commercial thinning in POC cores prevents silvicultural acceleration of late-successional habitat; slight effect.	1] Permit commercial thinning in POC cores in Late-Successional Reserves. 2] Thin and leave material on site, if consistent with fuels objectives.
Wildlife and Fish	Possible isolated Clorox-related mortality of fish and other aquatic species from fire-suppression water drops in Alternatives 1, 2, and 3.	1] Attempt to limit water drops on streams by educating suppression crews of the risk so they can direct drops accordingly. 2] Fly farther to get uninfested water. 3] Neutralize Clorox in water by adding aeration or treating with chemical neutralizer such as ammonium salts [which may have their own risks]. 4] Drop from higher-up to increase spread [limiting amount in stream] and increase volatilization [evaporation] of the active ingredient.
Fire	1 to 2% cost increase and potential increase in burned acres to implement disease-control measures in Alternatives 1, 2, and 3.	1] Remove POC disease control measures for fire-fighting, especially in dry weather and conditions where introduction risk is low.
Fuels	Slight reduction in acres of fuels treated in Alternatives 1 and 2, reduction in wildland/urban interface acres treated in Alternative 3.	1] Ease Alternative 3 POC core and buffer treatment restrictions for fuels treatment. 2] Improve fuel treatment flexibility by reducing seasonal or area restrictions for other resources.

Recreation	Some restrictions on OHV use and road access in Alternatives 1 and 2; greatest in Alternative 3; could displace some users and intensify use in other areas.	1] Identify more appropriate use areas and educate using public. 2] Apply seasonal, rather that complete, closures where possible.
	POC mortality-related loss of scenic quality, especially near water-related activities; greatest in Alternatives 4 and 5.	1] Plant disease-resistant stock or alternate species in affected areas. 2] Design developed sites to keep use away from POC.
Wilderness	Possible POC mortality-related reduction in wilderness values; greatest in Alternatives 4 and 5.	1] Plant disease-resistant stock or alternate species in affected areas consistent with management policies. 2] Try eradication treatments if permitted by management policies.
Areas of Critical Environmental Concern and Research Natural Areas	Areas devoted to botanical study or exceptional value adversely affected by POC mortality; greatest with Alternatives 4 and 5.	1] Specifically limit access. 2] Educate user to the risks and provide shoe-cleaning stations. 3] Add PL considerations into the management plan for each area.
Cultural Products for Tribes	Slightly reduced access to products from road and area closures and harvest restrictions in Alternatives 1 and 2, and more so in Alternative 3.	1] Make exceptions for Tribal collections. 2] Work with Tribes to identify collections areas.
	Slight but immeasurable POC mortality-related reduction in long-term collectable POC products; greatest in Alternatives 4 and 5.	1] Plant disease-resistant stock or alternate species in affected areas. 2] As large-tree mortality occurs, harvest and store logs for later use.
Special Forest Products	Nearly complete restriction on POC bough sales, and slight restrictions on firewood, mushrooms, and other products, in Alternatives 1 and 2, and more so in Alternative 3.	1] Educate collectors about risks and direct them to open collection areas. 2] Identify bough collection areas for long-term stewardship contracting. 3] Encourage development of private POC bough orchards.
Timber Harvest	At least $0.35/thousand board feet increase in harvest cost in Alternatives 1, 2, and 3, and 1.7% PSQ reduction [0.7 million board feet] in Alternative 3.	1] Do not apply Alternative 3 POC cores to Matrix lands. 2] Designate the POC cores and buffers as Late-Successional Reserves and remove Late-Successional Reserve designation from corresponding habitat elsewhere [a Northwest Forest Plan amendment].
Environmental Justice/Civil Rights	Loss of 8 timber jobs in Alternative 3, and loss of 6 POC bough collection jobs in Alternatives 1, 2, and 3.	See mitigation for Timber Harvest and Special Forest Products.

Chapter 3&4 — Affected Environment and Environmental Consequences

Introduction

Chapter 3 (Affected Environment) and Chapter 4 (Environmental Consequences) have been combined in this document to more clearly present information to readers. The description of a resource or environmental component appears just before the description of environmental effects to that resource or component. Most environmental impact statements (EISs) place these sections in separate chapters.

This chapter presents information about those aspects of the environment that are likely to be most directly affected by the management prescribed in the alternatives, those whose ecological, Tribal, or product use or function might be significantly affected by POC management. It also presents the direct and indirect effects (or impacts) of management under the alternatives. This constitutes a presentation of the cumulative impacts of each alternative. Together these form the scientific and analytic basis for the Comparison of the Effects of the Alternatives section in Chapter 2.

Incomplete and Unavailable Information

One step in preparing an EIS is to evaluate whether information about effects of a proposed action is incomplete or unavailable and, if so, to disclose that fact and make certain findings about the relevance, importance, and/or costs of acquiring data that could help fill any such gaps.

When encountering a gap in information, the question implicit in the Council on Environmental Quality regulations (40 CFR 1502.22(a)) on incomplete or unavailable information was posed: Is this information

> . . . essential to a reasoned choice among alternatives?

While additional information would often add precision to estimates, the basic data and central relationships are sufficiently well established that any new information would not likely reverse or nullify relationships. Although new information would be welcome, no missing information was identified that is essential to a reasoned choice among the alternatives.

As noted in the Background section of Chapter 2, Port-Orford-cedar (POC) root disease was introduced to the natural range of POC more than 50 years ago, after raising the concern of nursery pathologists in the Seattle, Washington, area for decades previous to that. Scientific study and management experience by the Agencies and others is considerable. Pathologists with the Forest Service, States of Oregon and California, and Oregon State University, have devoted years to the study and management of POC root disease.

The management practices discussed in the alternatives are generally ones with which the Agencies are well experienced. While conclusive research regarding the effectiveness of each specific practice is sometimes weak or lacking, basic studies of disease indicators have been at least minimally studied for nearly every practice, sufficient to make professional judgments regarding their likely effectiveness. For example, while the effectiveness of washing vehicles on reducing the spread of the disease has not been studied directly (because of the numbers of variables involved), washed vehicles have been reexamined, finding that washing reduced inoculum about 95 percent. A reduction in the risk posed by a washed vehicle traveling through uninfested areas is thus appropriately inferred.

Neither are the observed pathology relationships unique to POC. Where conclusions or inferences must be made without complete POC data, scientists rightfully build on data from similar relationships or results with similar pathogens more thoroughly studied. Subsequent new information about POC root disease has historically supported such inferences, although the new data improves precision.

A source of potential uncertainty arises from both the geographic and temporal scales of this analysis. POC mortality under each of the alternatives is projected for 100 years, and is based on several assumptions founded on the past 50 years of study and experience. While these assumptions are reasonable, they are by no means certain to 100 years. Monitoring is prescribed to detect significant departures from predicted disease spread that would trigger further analysis as warranted.

Normally, uncertainty exists when evaluating effects at the programmatic scale (such as this supplemental EIS [SEIS]), because the proposed action neither authorizes nor evaluates any specific management proposal. To the extent such uncertainty might relate to disease spread, it is considered minor. Assumptions in this SEIS about forest management activities, for example, are based on consideration of 50 years of forest management activities. And while the standards and guidelines of the various alternatives provide for site-specific application of various management practices based upon consideration of the conditions at each site, both the language of the standards and guidelines and experience with implementation and with existing forest conditions make reasonable predictions about such application possible. Nevertheless, site-specific effects of management can only be known, with any degree of specificity, at subsequent, site-specific levels of analysis and planning. Effects are projected in broad terms for purposes of the analysis in this SEIS.

Some scoping comments expressed a belief that POC is on its way to becoming extinct or only minimally represented within its natural range, and that only closing access to the forest will save the cedar. The analysis displayed in the following sections does not support such a position. Because the pathogen requires nearly standing water to infect trees, high-risk areas are limited and definable. POC even a few feet away from water or seasonally saturated soils is at little risk regardless of the management strategy imposed. Further, it is possible to make reasonable predictions about the future spread of *Phytophthora lateralis* (hereafter referred to as PL), the disease-causing pathogen. Other than Pacific yew growing with POC, the pathogen affects only POC and does not have an alternate or hidden host, nor does it travel through the air. PL has a narrow genetic range, and so is not likely to adapt to different species or even to resistant POC. Predicting the spread of the disease and the resultant adverse environmental effects is possible, at least to a sufficient degree that the selection of one of the action alternatives will yield a predictable environmental effect.

Considerable precision (and thus, certainty) could be added to this analysis if Agency POC maps were more detailed and then individually analyzed for relevant risk levels and agents. Existing maps are based partly on stand or vegetation-type inventories or stand exam maps and sometimes do not reflect the specific location of included POC. As discussed in the background section, the precise number of acres of POC is unknown, and varies depending upon the mapping criteria used. These details can be correctly relegated to site-specific analysis. The existing information, coupled with existing scientific knowledge of diseases as a whole, is sufficient to establish basic relationships well enough that any new information would not likely reverse or nullify these relationships. There is sufficient information about the pathogen and about the effects of the various alternatives for decision-makers to confidently make a reasoned choice from among the alternatives.

Cumulative Effects

Cumulative impacts to the environment are defined in the Council on Environmental Quality regulations as those that result from the incremental effects of a proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of which agency or person undertakes them (40 CFR 1508.7). Given the programmatic nature and scale of this SEIS, most of the environmental consequences discussed represent a general projection of the accumulated effects of management actions that are reasonably assumed to occur under the various alternatives and in the context of other existing standards and guidelines and practices on the affected Federal lands, and on other Federal and private lands within the range of POC. Spatial and temporal features of the analysis are discussed as follows.

California Portion of the Range

The natural range of POC extends from the planning area into the northwest corner of California. Approximately 10 percent of the POC found on Federal lands is within California, located on the Six Rivers, Klamath, and Shasta-Trinity NFs (and Redwood National Park). These Forests are cooperators in this SEIS, and helped with the analysis. Although the action alternatives do not apply to these Forests, some of the effects sections in this chapter specifically include California because of the possibility of transporting the disease back and forth across the border. Timber hauling, equipment movement, and other factors are discussed within the Pathology and Timber Harvest sections specifically, and do pose a small but potential risk of cross-state infestation. The existing management direction for the California Forests is included in the description of Alternative 1 in this SEIS, and held constant across the action alternatives. As described in the Pathology section, projections for Alternative 1 apply, to the detail of this analysis, to the California Forests. Selection of an alternative that is less or more active in restricting spread of the disease will have a slight but corresponding change in the risk of the pathogen being transported to California. The Avoid Disease Export standard and guideline in Alternatives 2 and 3 is specifically designed to reduce movement of PL offsite, including to California.

Private and Tribal lands account for an estimated 2,000 to 5,000 acres of POC in California. There are no known infestations of PL on California Tribal lands. The Hoopa and Yurok Tribes follow management practices designed to minimize the potential for introduction of PL and to limit its impact if an introduction occurs. Significant populations of POC are present on California State Park land at Jedediah Smith and Castle Crags State Parks. POC along the Sacramento River at Castle Crags State Park is infested with PL where, because of its proximity to Interstate 5, it poses a risk for importation to other parts of the POC range. POC is harvested on other private timberlands in California, with approximately 100 to 200 thousand board feet shipped to Oregon annually for milling or export (see Timber Harvest on Private Land section for further details).

Port-Orford-Cedar Management on Non-Federal Lands in Oregon

There are no requirements for POC management in the "Oregon Forestry Practices Act." A few private landowners in the range of POC have requested information on cedar management from local Forestry Assistance foresters. Usually the information provided is of a general nature, and includes management practices such as operating during the dry season, avoiding sites infested with PL, and avoiding roads and skid trails in stands with a POC component. However, little attention is given to POC by most small-tract landowners. Several private landowners have test plantations of resistant stock provided by the Forest Service's Dorena Genetic Resource Center. There is interest among private woodland groups in the availability of this resistant stock for future plantings.

Non-Federal lands near Coos Bay contain approximately 8,500 acres of non-roadside infestation (compared with 319 acres on the Coos Bay BLM District) and represent a chronic source of PL for export to other lands throughout the range. An infestation in the Sacramento River drainage in California is believed to have been transported on logging equipment from the Coos Bay area. The likelihood of such long-distance spread is discussed in the Pathology section and considered in disease projections.

Timber Harvest on Private Lands within the Range of Port-Orford-Cedar

Silvicultural practices on private lands within the range of POC include commercial thinning and regeneration harvesting and their related treatments of burning, planting, spraying of herbicides, pre-commercial thinning, pruning, and fertilization. Recent declines in Federal harvests, economic conditions, and the increase in mills specializing in smaller material has led to shorter rotations and more regeneration harvesting. Rotation ages average 45 years on the coast, and 60 to 90 years in the interior.

Approximately 70 percent of private timber harvest is done with skyline cable-yarding systems and the balance is done with ground-based systems on slopes less than 40 percent slope. The likelihood of PL spread is substantially reduced with skyline cable-yarding, whether partial or full suspension. Ground-based systems have the highest likelihood for spreading PL, assuming they pass through infested areas. These risks would be greatest during wet soil conditions.

Almost no roadside POC sanitation (clearing to prevent infection starts) occurs on private lands within the range, while some large, private, industrial timberland owners are washing heavy logging equipment for noxious weed control. This equipment washing probably has some benefit in slowing the spread of the POC root disease. Small private landowners typically do not wash heavy equipment.

The percent of each county in the POC range that is private, and the annual volume and estimated acres harvested are shown in Table 3&4-1. Private harvest acres have been estimated using the regional average rotation age, total harvest volume, and proportion of volume coming from regeneration or partial cutting and their respective assumed volumes per acre. Table 3&4-1 includes both clear-cut and partial-cut acres.

Within the natural range of POC, the probable sale quantity (PSQ) on Federal lands is 49 million board feet annually for Oregon, and 23 million board feet for California. Thus, on a yearly average basis, the total timber harvested within the range of POC is about 550 million board feet, with private lands representing 87 percent. The estimated acres cut and its potential contribution to the spread of PL are expected to continue at these relative levels into the foreseeable future. The mill capacity is 700 million board feet/year for southwestern Oregon, with most mills along the Interstate Highway 5 corridor with a few mills along the coast. Approximately 40 million board feet of logs (not counting POC, discussed below) from private lands are shipped annually to mills in southern Oregon from northern California. This represents about 8,000 truckloads of logs.

Management of POC root disease on Federal lands is affected by private land management in several ways. Equipment used to harvest on Federal lands is supplied by private contractors who also work on private lands. This includes logging equipment that moves from sale to sale, and trucks that may haul from different sales in different areas or states from one day to the next. Trucks transporting logs from private lands often travel roads through Federal lands, particularly in "checkerboard" ownerships and on reciprocal right-of-way agreement roads. Also, trucks from various areas or even states are often unloaded at the same loca-

Table 3&4-1.—*Average yearly private harvest levels for all species within the natural range of Port-Orford-cedar, 1995–2001*

County	% private lands [1]	Volume harvested in millions of borad feet [1]	Estimated acres harvested
Oregon			
Coos	70	183	6,700
Curry	84	49	1,790
Douglas	12	42	1,550
Josephine	45	12	970
Total	39	286	11,010
California			
Del Norte	74	36	1,310
Humboldt	14	63	2,320
Siskiyou	14	21	2,080
Trinity	62	49	4,930
Shasta	20	20	2,060
Total	20	189	12,700
Total	29	475	23,710

[1] *Source:* Oregon Department of Forestry Annual Timber Harvest Report for Western Oregon by County and California State Board of Equalization Timber Harvest Tax Records from 1995 to 2001.

tions, often minutes apart; although as noted in the Timber Harvest section, the possibility for spore exchange in this case is very slight. The same possibilities for transport exist from Federal to uninfested private lands, reduced by the PL management requirements implemented on those Federal activities.

Federal administrative units whose POC management practices would be affected most by this level of private timber harvest are Coos Bay, Medford, and Roseburg BLM Districts, located in Coos, Curry, Douglas, and Josephine Counties. The POC lands on these districts are primarily checkerboard, intermixed with private ownership; most of the volume hauled on roads through BLM lands in these areas is from private lands, with little Federal latitude to limit season of use or require vehicle washing. Other Federal administrative units with more contiguous land ownership would experience less likelihood of importing PL from private land management activities.

Although harvest of any species within the range of POC (as discussed above) is indicative of a risk of transporting POC root disease, harvest and transport of POC itself is more likely, in a single event comparison, to result in the transport of root disease. However, annual harvest of POC on private lands varies widely depending upon market conditions. The harvest levels shown in Table 3&4-2 are probably unusually high, based on a peak in demand that drove the price to a high of $12,000 per thousand board feet for top quality logs.

Nearly all POC harvested in California is transported to mills in Oregon or export facilities in Oregon or Washington. This amounts to about 840 truckloads from Humboldt and Del Norte Counties, based on 4.2 million board feet/year (Waddell and Bassett 1996, *Table 29*).

During Fiscal Year 2000 approximately 0.8 million board feet of POC was exported from the northwest to Japan, China, Korea, and Taiwan from the ports of Longview, Coos Bay, Portland, and Seattle. There are no POC export ports in California; all POC harvested for export in California is shipped through Oregon. Recently, POC logs shipped from the Port of Coos Bay in Fiscal Year 2000 averaged 257 thousand board feet (Warren 2002). By 2002, this had dropped to 200 thousand board feet (Green 2003). Overall export trends for POC continue to decline as the overseas demand continues to drop due to economic conditions and the increased production of Hinoki cypress (*Chamaecyparis obtusa*), which is used in Japanese temples.

Several mills in Oregon saw about 4.5 million board feet of POC annually for lumber, paneling, and decking. These mills are located in Bandon, Glide, Myrtle Point, Riddle, and Roseburg. Since the overall export prices for POC have dropped, these mills have been able to purchase more POC. Sources of POC logs include both Oregon and northern California. Approximately 100 to 200 thousand board feet of California POC logs are shipped to Oregon

Table 3&4-2.—*Port-Orford-cedar standing inventory and harvest volume for private lands*

Counties	Standing inventory [millions of board feet]	Annual harvest [millions of board feet]	Years
Coos, Curry, Douglas, Josephine	94	3.5	1995-97 [1]
Humboldt, Del Norte	23	4.2	1991-94 [2]

[1] Tables 8d and 10d in Azuma et al. [2002].
[2] Tables 9 and 11 in Waddell and Bassett [1996].

annually representing 20 to 40 truckloads of logs (5 thousand board feet/truck). Mill production is limited by the supply of POC logs, as their product demand is strong.

Long-distance Spread Associated with Various Federal Forest Activities

To the extent such information is known and quantifiable, sections in this analysis describe the nature and extent of forest activities known to contribute to the spread of PL. The Timber Harvest section specifically addresses the general number and origin of log trucks and other equipment, and the movement of logs within the range. Recreation uses, the collection of forest products, and other uses are also described. These activities are taken into account in the pathologists' predictions of spread, both spatially and over time.

Temporal Effects

The Pathology section predicts mortality percentages at 100 years, and other secondary effects sections address this same time period. As explained in that section, the spread rate in any one area will not be constant, but will follow an "S" curve typical of similar disease infestations and readily recognizable within POC areas exposed to the pathogen for some time (see Pathology section). Monitoring will continue to validate these assumptions.

Relationship of this Supplemental Environmental Impact Statement to the Northwest Forest Plan

The Northwest Forest Plan was adopted April 13, 1994, as an amendment to land and resource management plans within the range of the northern spotted owl (including the plans that would be amended by the action alternatives in this SEIS). The Northwest Forest Plan added standards and guidelines to existing or draft (underlying) management plans for management of habitat of late-successional forest-related species and protection of watersheds. The Northwest Forest Plan did not address POC because it was outside its scope and purview. The management direction addressed in this SEIS is part of the underlying management plans, and no amendment to the Northwest Forest Plan is proposed. Further, none of the alternatives proposed would

> . . . significantly reduce protection for late-successional or old-growth forest related species, or reduce protection for aquatic ecosystems (USDA and USDI 1994b, *p. C-29*).

Therefore no review by the Regional Interagency Executive Committee is required. Nevertheless, an understanding of the Northwest Forest Plan land allocations is helpful to understanding this analysis.

The Northwest Forest Plan amended the land and resource management plans of the various administrative units, primarily by establishing a system of reserves (certain land allocations), and providing standards and guidelines limiting or directing activities within those reserves. Approximately 80 percent of Federal lands were assigned to a reserve land allocation that precludes regularly scheduled timber harvest. This resulted in a reduction in timber harvest levels of about 80 percent, and a reduction in road construction miles of over 90 percent, when compared to levels in the 1980s. Although there have been more restoration projects, and some reserves permit habitat-improving silvicultural activities including commercial thinning, there has been a substantial reduction in the level of management activity and heavy equipment use on Federal lands as a result of the Northwest Forest Plan.

A description of the Northwest Forest Plan land allocations found in the planning area is as follows:

Congressionally Reserved—In the planning area this includes designated wilderness.

Late-Successional Reserves—These areas are managed to protect and enhance conditions of late-successional and old-growth forests. Limited stand management is permitted to improve late-successional and old-growth conditions or protect the areas from wildfire and other large-scale disturbances.

Adaptive Management Areas—These areas are identified, each with an objective to develop and test new management approaches to integrate and achieve ecological and economic health, and other social objectives. Regularly scheduled timber harvest (those contributing to PSQ) may occur in Adaptive Management Areas.

Administratively Withdrawn Areas—These are areas where the underlying direction in existing land and resource management plans precludes regularly scheduled timber harvest. These areas include recreation and visual areas, back country, administrative sites, research natural areas, and areas of critical environmental concern.

Riparian Reserves—These provide an area along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Silvicultural activities are permitted only when watershed analysis shows treatments are needed to achieve watershed objectives.

Matrix—This includes all other lands. Management of these lands is guided by some Northwest Forest Plan direction for Matrix, but primarily by the direction in the underlying land and resource management plans. Approximately 75 percent of the matrix consists of lands suitable for regularly scheduled timber harvest.

In many ways the reserve system of the Northwest Forest Plan created de facto protection areas for POC. Certainly the risk of exposure has been reduced for many POC stands as a result of these allocations. Table 3&4-3 shows gross acres and acres occupied by POC, within each of the land allocations of the Northwest Forest Plan for Oregon.

Table 3&4-3.—*Gross Oregon Federal and presence of Port-Orford-cedar (acres) by Northwest Forest Plan land allocation within the natural range of Port-Orford-cedar in Oregon*

	Congressional/ Administrative Reserve		Late-Successional Reserve		Matrix/Riparian Reserve/Adaptive Management Areas [1]		Total	
Administrative unit/Risk region [2]	Gross [3]	POC [4]	Gross	POC	Gross	POC	Gross	POC
Coos Bay BLM	3,074	229	45,941	18,797	106,101	53,979	155,116	73,005
Powers Ranger District	18,481	1,342	85,841	44,508	20,015	7,393	124,337	53,243
North Coast Risk Region total	21,555	1,571	131,782	63,305	126,116	61,372	279,453	126,248
Roseburg BLM	635	0	45,417	2,056	39,213	2,630	85,265	4,686
Medford BLM	26,829	4,404	119,355	17,277	85,971	2,974	232,155	24,655
Inland Siskiyou Risk Region total	27,464	4,404	164,772	19,333	125,184	5,604	317,420	29,341
Siskiyou Risk Region total [Siskiyou NF, except Powers Ranger District]	256,996	19,735	485,780	71,010	182,332	25,629	925,108	116,374
Grand total	306,015	25,710	782,334	153,648	433,632	92,605	1,521,981	271,963

[1] Riparian Reserves are lumped with Matrix because actual Riparian Reserves are mapped onsite during project planning; about 50 percent of the acres shown are Riparian Reserve, with the other 50 percent being Matrix or Adaptive Management Areas.
[2] For "risk regions" see Pathology section.
[3] Gross acres within the range of POC.
[4] Acres with POC present.

Assumptions and Clarifications

The effects discussions are based on the standards and guidelines of each alternative and their referenced appendices. As indicated by Appendix 2, the Agencies have considerable experience with the management techniques prescribed by the standards and guidelines and the effects of POC mortality, and so are able to estimate the future effects of the various alternatives with some degree of certainty. That experience leads to certain underlying assumptions that are stated here for clarity for the reader, and to assure consistency within the analyses. The following assumptions or clarifications are pertinent to the analysis or to the decision to be made.

- The analysis assumes the Northwest Forest Plan will be implemented as written and intended. Effects to harvest levels, for example, are based on declared PSQ levels rather than the level experienced in the past 3 years when litigation has limited activities. This potentially conservative assumption assures adequate effects analysis if activity levels return to levels anticipated in the Northwest Forest Plan.

- The analysis only considers effects to POC within its natural range. POC has been planted, both as an ornamental and as a forest tree, throughout the world. Plantations outside the range occur in many areas including (unwanted) in parts of the Redwood National Park. The alternatives are not intended to apply to those areas. The effects of the various alternatives on such plantations is inestimable. Local managers may choose to apply management practices suggested in this SEIS, but no such assumptions are made here.

- Private interest in POC will likely increase if resistant stock is available. The species provides valuable products, may be resistant to *Phytophthora ramorum*, the cause of Sudden Oak Death, may help diversify stands to reduce the effects of Swiss Needle Cast in Douglas-fir, can be grown in very wet areas, and is manageable within a wide range of ecological conditions.

- There will be adequate funding to implement the requirements of the selected alternative. If monitoring is required, for example, it will be funded. Funding is not necessarily expected where the writer provides the caveat “to the extent funding is available”, or similar language, although such a case would obviously require funding to achieve the specific effect to which that author refers.

- The ability to restrict traffic on lands in “checkerboard” ownerships is severely restricted by the terms of the reciprocal right-of-way agreements governing most roads. Written in the 1950s and 1960s to ensure only one set of roads was built to access both private and Federal lands, the agreements provide intermingled owners with a deeded right to use these roads essentially as if they were their own. The results of court challenges to these roads based on the “Endangered Species Act” have affirmed these rights (see Alternatives Eliminated from Detailed Study in Chapter 2 for more detail).

- Fire suppression activities will follow the standards and guidelines only to the extent they do not jeopardize life and property or do not, as a result of the fire’s daily resource analysis, result in more damage to POC than would be expected to occur by more aggressive fire suppression. This issue is specifically addressed in the standards and guidelines of Alternatives 2 and 3, and does not apply to Alternatives 4 and 5. A detailed explanation of fire suppression and root disease control considerations on the Biscuit Fire is included in the Fire/Fuels section.

- Facts, analysis, and conclusions displayed in this SEIS may be different than similar data in the Agency's 2003 "Range-Wide Assessment of Port-Orford-Cedar on Federal Lands" (USDA and USDI 2003a). The Assessment is primarily an internal document that has been several years in the making. Data may be outdated, or analyses not to EIS standards. Generally, where information from the Assessment has been incorporated into this SEIS, it has been incorporated in its entirety with appropriate references, and therefore stands alone.

- Legal compliance by the public, and the effectiveness of Agency law enforcement, will be reasonable but not absolute. Gates and other area closures will be respected most of the time. Public information efforts will continue to be successful. Firewood and other forest product collectors will stay out of closed areas most of the time, and violators will sometimes, but not always, be caught and cited. Occasional violations of area closures are specifically acknowledged in the Pathology and Botany sections.

- Within Alternatives 2 and 3 is a risk key containing a decision criteria reading "2. Will the proposed project introduce significant risk of infection to these uninfected POC?" This question does not consider the level of POC in the project area—those levels are already covered by earlier questions. (Question 2 may, however, consider the location of the POC relative to the risk-producing activities.) Question 2 focuses only on the possibility or likelihood (risk) that the proposed activity will introduce the pathogen to the area in sufficient quantities to begin an infestation. "Significant" in this context does not mean "any". It means that a reasonable person would recognize enough risk to believe mitigation is warranted and would make an appreciable or important difference.

Port-Orford-Cedar Background

Port-Orford-cedar (*Chamaecyparis lawsoniana* [A. Murr.] Parl.) is the largest species of its genus and the largest representative of the family Cupressaceae in North America. It is a valued timber tree and is also planted worldwide as an ornamental (USDA-FS 1965).

Species Range

POC is a regional endemic, native only to southwestern Oregon and northwestern California. The range of POC includes portions of the Oregon Coast Range, Siskiyou Mountains, California Coast Range, and Klamath Mountains. The northern limit of the species occurs on coastal dunes north of North Bend. The southern end of the species' range is in Humboldt County. Longitudinal distribution is greatest in California (see Figure 1-1). The range narrows south and north of this area. Range limits in the south and east coincide roughly with the 1,000-mm isohyet. Disjunct populations are associated with areas of locally high precipitation about 93 miles inland, near the headwaters of the Trinity and Sacramento Rivers (Hawk 1977).

Autecology

POC is restricted in geographic range but has a wide ecological breadth, occurring in many diverse habitats (Zobel et al. 1985). POC has moderately high shade tolerance, and is more tolerant than incense-cedar, sugar pine, Douglas-fir and western white pine, and less tolerant than Shasta red fir, Brewer spruce, white fir, Sitka spruce, grand fir, western red cedar, and western hemlock. Other studies show POC able to reproduce well in all but the darkest microsites, including late-successional stands. Zobel and Hawk (1980) found POC to survive under shade as well or better than all its competitors except western hemlock.

In addition to being shade tolerant, POC is tolerant of repeated fire (Hawk 1977). Even as pole-sized trees, POC has a good chance of surviving fires (Zobel et al. 1985). Fire resistance is less than that of Douglas-fir, but greater than that of the true firs or western hemlock. POC is often the first species to reinvade after fire.

POC occurs over a wide variety of soil types (Hawk 1977). The species outcompetes most of its competitors on ultramafic soils, but is not restricted to these soils and grows better in laboratory studies on other soil types. At low elevations, POC is frequently associated with ultramafic soils. Higher elevation sites occur on a wider array of soil types (Zobel et al. 1985).

POC is characterized as having fairly low drought resistance (Zobel et al. 1985), and its requirements for moisture during the growing season may limit its distribution. POC is considered more drought-tolerant than western hemlock and Sitka spruce, but is less tolerant than Douglas-fir, Jeffrey pine, incense cedar, sugar pine, and most other trees found in its range (Zobel et al. 1985).

Geomorphic Position

POC occurs in all physiographic locations from sea level to 6,400 feet elevation on the seaward slopes of the Coast Range and Klamath Mountains (Hayes 1958). POC forests occur most frequently on northwestern aspects; 82 percent of plots collected by Hawk (1997) were on aspects 200 to 45 degrees azimuth (Zobel et al. 1985). Most of the POC communities identified by Hawk (1977) were in midslope landscape positions.

Moisture Regime

The climate in much of the range of POC usually has wet winters, dry summers, relatively uniform temperatures, high relative humidity, and frequent summer fog. Away from the coastal influences, in the south and east portion of its range, rainfall, relative humidity, and summer fog are decreased, while the temperature fluctuations in both the summer and winter are greater (USDA-FS 1965).

Moisture regime strongly influences plant community development within the range of POC. POC seems largely restricted to moist sites where the regionally common species (Douglas-fir and western hemlock) grow poorly. To most populations of POC, a consistent abundance of water seems a critical necessity (Zobel et al. 1985). Where Douglas-fir is present it outcompetes POC for water. Only in the northern part of the range does the ratio of available water to evapotranspiration compensate for this competition (Zobel et al. 1985). POC may outcompete Douglas-fir in areas with low macronutrients, or cold or saturated soils.

Summary of Limitations on Distribution

POC is restricted in geographic range but has a wide ecological breadth, occurring in many diverse habitats (Zobel et al. 1985). Zobel et al. (1985) suggest limitations on POC distribution acting at four levels: microenvironmental, geomorphic surface, regional, and geographic scales. At the microenvironmental scale, moisture near the surface and high water potential in summer, absence of extreme shade, and mineral soils may be essential to seedling success. At the geomorphic surface-scale, POC seems generally limited to landscape positions that assure a consistent supply of groundwater. These include high water table and seep areas, streams or lakeside areas, slumped areas, and positions with significant watershed area above to maintain soil moisture.

At the regional scale, geology and climate affect distribution. For example, the importance of ultramafic substrates is clear. Higher humidity in coastal zones can compensate for low soil moisture locally. Finally, at the geographic scale, Zobel et al. (1985) suggest changes in precipitation/evapotranspiration ratios and decreases in ultramafic substrates traveling south and east, and increased competition with other conifers in the northern portions of the range.

Several factors mitigate the above-described constraints. North-facing aspects and areas experiencing summer fog also maintain microsite conditions supporting POC in upper slope positions without significant seeps. Also, lithology (bedding tilt) can frequently produce localized wetted soils within meters of local ridgelines. Thus, POC is frequently found in positions at or above midslope, and should not be considered a riparian species, but a mesic-to-moist microclimate-dependent species.

Life History

Some trees start to bear cones within 8 years under natural conditions and earlier in greenhouse conditions. Cone bearing becomes general by 20 years, is best at about 100 years, and continues for the life of the tree. Seed crops are frequent; heavy crops are produced every 4 to 5 years and some seed is usually produced every year. Squirrels do not commonly use POC seeds as food unless other species of seed are scarce. Most seed germinates soon after falling. Seedfall begins in September, reaches a maximum in winter, and continues through spring (USDA-FS 1965).

Natural reproduction is successful if there is a bare, mineral soil seedbed and sufficient moisture. POC survives well in plantations if animal browsing and competition from other vegetation is avoided (USDA-FS 1965).

In the most abundant portion of the range, POC is common in mixed stands up to 20 to 25 years old, after which it is usually overtopped and grows slowly. Once established, the species is relatively shade tolerant and long lived. It retains to an old age the capacity to respond if released from surrounding Douglas-fir and other overstory trees. POC is capable of moderately rapid growth if it not overtopped by other trees. Mature trees can reach 4 to 5 feet in diameter and 200 feet tall. Mature trees are generally older than 200 years (USDA-FS 1965).

POC is subject to windthrow. It has no taproot, and the numerous lateral roots are usually of a small diameter. The tree has a tendency to grow multiple stems at any height (USDA-FS 1965).

Distribution Across the Range

POC can be found with a variety of species with differing ecological requirements. These species differ across the range of POC. The wide ecological range of POC is reflected in the climatic diversity of the ecoregions and subsections in which it is distributed. These ecological units are defined based on their biotic and environmental factors that directly affect ecosystem function (McNab and Avers 1994). Ecoregions and subsections are used in the Ecology and Botany sections of this SEIS because they directly apply to various POC/other plant relationships.

Another approach for conceptualizing the distribution of POC across its range is used in the Pathology section. In this section, the range has been classified into three "risk regions," North Coast, Inland Siskiyou, and Siskiyou, based on the percentage of POC that is on sites at high risk for pathogen spread. While these classifications have some general relationship to the ecoregion and subsection approach, they do not match completely. The relationship between POC acres using the two approaches is show in Table 3&4-4. Following are basic descriptions of the existing conditions within the risk regions.

Table 3&4-4.—*Port-Orford-cedar acres on BLM and FS lands grouped by ecoregion and pathology risk regions, Oregon and California*

	Pathology Risk Regions					
	Oregon			California		
Ecoregions	North Coast Region	Inland Siskiyou Region	Siskiyou Region	Siskiyou Region	Disjunct California	Totals
Northern Coast	124,070	1,543	22,464			148,077
North Inland	291	20,367	17,909	13,724		52,291
Mid-Coast	1,887	5,273	50,120			57,280
Mid-Range		2,158	25,881	16,951		44,990
Southern Range				3,001		3,001
East Disjunct California				1,142	1,142	1,142
Totals	126,178	29,341	116,374	33,676	1,142	306,781

North Coast Risk Region

The North Coast region is part of the Oregon Coast Range. This is an area of low mountains with high rainfall and dense coniferous forests. It has moderately sloping, dissected mountains and sinuous streams. The most important characteristic in terms of species composition is the occurrence of western hemlock as a dominant or codominant species. The Federal administrative units that basically cover this region are the Siuslaw NF, Oregon Dunes National Recreation Area; Coos Bay BLM District; and the Siskiyou NF, Powers Ranger District.

Oregon Dunes National Recreation Area (FS)

The natural range of POC extends into the southern end of the Coos Bay dune sheet and the Oregon Dunes National Recreational Area of the Siuslaw NF.

Approximately 50 acres of old-growth POC are isolated by dunes and are managed to maintain, restore, or enhance its condition. These stands are 150 to 350 years old and appear to be healthy and free of PL infection. Off-highway vehicle use and a number of other activities within and adjacent to these POC stands is prohibited.

Approximately 40 additional acres of POC are found on the Oregon Dunes National Recreational Area as generally scattered individual trees or small pockets of younger trees with PL infection known or suspected within the area. Most are adjacent to roads, railroad tracks, or private lands, and about half are in areas open to off-highway vehicle use.

Coos Bay BLM District

Land ownership patterns within the Coos Bay District are checkerboard and scattered parcels of public domain lands interspersed with both private industrial forestlands and private individual landowners. All drainages on the Coos Bay District consist of mixed ownerships.

PL has been present within the Coos Bay BLM District boundary for over 50 years with the first POC trees exhibiting symptoms of PL in 1944 at the Oregon Marine Biological Station in Charleston, Oregon. The first confirmed sites were identified in Coos Bay, Oregon, near Mingus Park, just north of the North Bend McCullough Bridge, and in Charleston, Oregon (Roth et al. 1957).

According to the District's GIS database, there are 82,410 acres of POC on the Coos Bay BLM District with 319 acres of non-roadside PL infestations and 2,391 acres of roadside considered infested.

POC grows throughout the forest landscape and is only a minor component of local riparian habitats. Most of the PL infections within the area occur on private lands from Lakeside, Oregon, to Gold Beach, Oregon, along the coast. Healthy POC is found throughout the landscape away from roads and streams. The vast majority of POC and PL on Coos Bay BLM District lands is in the south half of the district, south of the North Fork Coquille and Coos River drainages. Nearly all drainages within the Coos Bay District are infested with PL. A few uninfected 7^{th} field watersheds are at the northern most end of the natural range. These areas have small scattered populations of POC intermixed with stands of Douglas-fir, western hemlock, and western red cedar.

Planting of POC seedlings as part of the species mix has occurred on all regeneration harvest units since Fiscal Year 2000. Planting, annual maintenance, and precommercial thinning of plantations preserve minor species, including POC, in areas away from roads and streams.

Siskiyou National Forest, Powers Ranger District

The Powers Ranger District has the greatest concentration of POC in the world, from the South Fork of Coquille River to Iron Mountain. This district is also unique in having stands with compositions of POC up to 70 to 80 percent. Included within the district are the Port-Orford-cedar Research Natural Area, Big Tree Viewing Area, which includes the largest POC in the world at nearly 12 feet in diameter, and the Coquille River Falls Research Natural Area.

The district has been active in the inventory of POC through district-wide road surveys in 1964, 1972, 1983, 1992, and 1999. Since 1999, individual road segments connected to project proposals have been surveyed. These surveys, combined with extensive aerial photo and ground verification surveys in 1997, have identified a total of 62,323 acres of POC present on the district, of which 9,447 acres are infested with the PL root disease. Based on survey information and observations, there are few acres of new infestation appearing with each new survey. Most of the roads on the district have been open to the public since their construction and have already become infested.

Private Lands in the Region

With the prolific seed production of the species and excellent POC growing conditions along the coast, the corridor of lands along the Highway 101 from Lakeside in the north to Port-Orford, Oregon, in the south, is a rich environment for PL infestations. There are approximately 880,000 acres of non-Federal lands within the Coos Bay BLM District boundary within the POC range (from the range map), with an estimated 50,000 of these acres containing POC. Aerial photography interpretation indicates there are approximately 8,500 acres of non-roadside PL infections on these lands. In 1953 these private lands contained 69 percent of the total POC timber in Oregon, 15 percent on BLM, and 16 percent on NFs (Peattie 1953). The low coastal terraces and abundant standing water in this area result in a high percentage of POC being on sites at high risk for PL infection. The mortality rate calculated from forest inventory plots is consistent with aerial photo disease mapping done by the Coos Bay BLM District.

Inland Siskiyou Risk Region

This region has a high diversity of conditions, which is reflected in the vegetation. POC in this region is often associated with ultramafic soils, and co-dominates the timber stands on these soils with Jeffery pine and incense cedar. The vegetation on other soil types is dominated by the Douglas-fir with scattered POC. POC grows on Federal lands intermingled with private landholdings. It exists as occasional large trees with many seedlings growing underneath. The Federal administrative units that basically cover this region are the Roseburg and Medford BLM Districts.

Roseburg BLM District

Overlapping the northeastern-most portion of the native range of POC, the Roseburg BLM District has approximately 5,000 acres of forestland occupied by this species. The POC on the district grow in the Coast Range west of the Umpqua River, south to the southern area of Camas Valley, then crossing Highway 42 into the Twelve-Mile drainage. POC grows sporadically along Buck Springs Ridge and Cow Creek and its tributaries, and also in the west fork of Middle Creek.

Less than 100 acres have some level of the root disease, primarily adjacent to highly visible roads. Infestations occur on interspersed private lands as well.

About 63 percent of the trees are less than 80 years of age. POC makes up generally less than 5 percent of the overstory of the stands in which it is found.

PL has probably been present on Roseburg BLM District since the early 1960s. Extensive road construction on both Federal and private lands probably facilitated the introduction of the disease during this period.

Medford BLM District

The natural range of POC extends into the western part of the Medford District. Of the four resource areas on the district, POC is natural in the Grants Pass Resource Area and the Glendale Resource Area. The Grants Pass Resource Area contains the majority of POC. Most of the POC on the Medford District is contained in the Williams Creek, Rogue River/Horseshoe Bend, Silver Creek, Rogue River/Hellgate and Deer Creek Watersheds. Surveys in these and other 5th field watersheds show 25,485 acres of healthy POC and 2,340 acres of infested stands.

The habitats in which POC is found are very diverse. POC on the district is often associated with riparian areas, but does occur in the uplands and on ridges. There are inclusions of coastal plant communities associated with POC as well as high elevation associations with Shasta red fir and Alaska yellow cedar. POC can be found on serpentine-influenced (ultramafic) soils that include western white and Jeffrey pine series.

Siskiyou Risk Region

This region includes the Coastal Siskiyous, Siskiyou Mountains, and Gasquet Mountain ultramafics located in Oregon and California. In the northwest part of the region, the Coastal Siskiyous have highly dissected mountains and high gradient streams, as well as a few, small, alpine glacial lakes. The climate is wetter with more maritime influence than the Siskiyou and Klamath Mountains to the south. The Coastal Siskiyou area has tanoak, Douglas-fir, and some POC. Western hemlock is present but not a dominant overstory species. This region has a high diversity of ecological conditions, which is reflected in the vegetation.

In the middle of the region, the Siskiyou Mountains are higher, steeper terrain than the other portions of the cedar's range in Oregon. It has a high diversity of conditions, which is reflected in the vegetation. The vegetation is dominated by Douglas-fir at low elevations, Jeffrey pine on ultramafic soils, and white fir and red fir series at higher elevations.

In the south portion of this region, populations of POC are highly scattered across the landscape and within many vegetation types. Marine air moderates temperatures in the western portion of this area, creating a temperate to humid climate near the coast. Douglas-fir and tanoak are the predominate trees in this part of the region. The southern extreme of this region stretches to southwest edge the Klamath Mountains into the northern California Coast Range. Many of the isolated populations of POC in this part of the region are often found on ultramafic soils.

The Federal administrative units that basically cover this region are the Siskiyou NF, Illinois Valley, Galice, Gold Beach, and Brookings Ranger Districts; Six Rivers NF; Klamath NF; Shasta-Trinity NF; Oregon Caves National Monument (FS); and Redwood National Park.

Siskiyou National Forest, Illinois Valley, and Galice Ranger Districts

Many of the POC within the Illinois Valley and Galice Ranger Districts range in age from 200 to 400 years old and are 20 to 60 inches in diameter. POC root disease has been present along the Oregon side of the Grayback Road going toward Happy Camp, California, since about 1960. Sanitation removals were implemented on the California side to reduce the potential for further disease introduction. So far, the root disease has not been found on the California side of the Grayback Road. In contrast, there has been considerable spread along this route and subsequent downstream movement in the years following introduction. The disease has spread to many stands, mostly along roads and down streams, east of Highway 199 on the Illinois Valley Ranger District. PL has infested the Grayback/Sucker Creek drainage near the Oregon Caves National Monument. The Wild and Scenic Illinois River and Briggs Valley area have a 6 to 40 percent stand composition of POC and are uninfested. Other major drainages in the Illinois Valley have scattered distributions of uninfested POC amidst steep topography.

POC is most often found in riparian areas within the Illinois Valley and Galice Districts. Generally, POC is within 100 feet of the stream; however, small groves of POC can be found on alluvial fans and benches along these streams. Crown closure in the streamside areas are from 10 to 50 percent.

There are upland populations on the many different soil types, including serpentine. POC is mixed with Douglas-fir, true firs, pines, and incense cedar up to approximately 4,500 feet elevation. In these mixed conifer stands, POC crown closure is generally 5 to 20 percent. Before the Biscuit Fire, POC on serpentine soils could be found from Josephine Mountain south to the Oregon boarder, where POC was scattered with white, knobcone, and lodge pole pines. In other serpentine areas, POC can be found with incense cedar and Douglas-fir. In these areas, POC crown closures are less than 2 percent.

Siskiyou National Forest, Chetco and Gold Beach Ranger Districts

POC can be found from Iron Mountain on the northern boundary of the Gold Beach District south to Mineral Hill. From there south, it is sparsely distributed and found only on the east side of the Chetco Ranger District. POC grows from near sea level, up to approximately 4,700 feet at Chetco Peak in the Kalmiopsis Wilderness.

POC is mostly found within 100 feet of the streams, but is also present in upland areas on many different soil types, including serpentine. POC is mixed with Douglas-fir, true firs, pines, and incense cedar. In the mixed conifer stands POC crown closure is generally 5 to 20 percent, but can be up to 80 percent in small isolated areas. Many of the POC within these districts are 200 to 400 years old and 20 to 60 inches in diameter.

PL has occurred along forest roads since about 1960. The disease has spread to many stands, mostly along roads and streams, following introduction.

Six Rivers National Forest

The Six Rivers NF includes the greatest extent of POC on Federal and State lands in California. These acres are spread over the northern portion of the forest and decrease in extent toward the south. The Gasquet Ranger District has about 67 percent of the POC on the Forest, primarily in the Smith River drainage. The Orleans Ranger District has about 30 percent of the POC on the forest, all in the Klamath River drainage. The southern-most POC in the natural range is on the Lower Trinity Ranger District. About 77 percent of the POC on the Six Rivers NF is found in riparian landscape positions.

POC root disease was noted on the Gasquet Ranger District by 1980 and has slowly spread to over 2,800 acres. The Orleans Ranger District has 157 infested acres and the Lower Trinity Ranger District has no recorded infestation to date. Most infestations are found in riparian habitats.

Klamath National Forest

There are no known PL infested stands or infected trees on the Klamath NF.

The distribution of POC on the Klamath NF is mostly limited to the Dillon, Clear, and Indian Creek Watersheds within the Siskiyou Mountains. On the Klamath NF, POC stands usually consist of small isolated pockets or narrow stringers and are nearly always confined to riparian areas. Most acres fall within the Riparian Reserve land allocation. The majority of POC acres are located within the Siskiyou Wilderness. Many of the POC stands in Matrix lands are generally in more accessible areas, but with limited direct road access to stands due to steep topography and riparian position.

Currently, the closest known infested sites are on the Illinois Valley Ranger District of Siskiyou NF and Orleans Ranger District of Six Rivers NF. The Illinois Valley site is close, via the popular Grayback Road, to uninfested sites within the Indian Creek Watershed of Klamath NF.

The 100-acre Sutcliffe Creek Botanical Area, which contains a stand of old POC, is located in the upper Indian Creek drainage of the Happy Camp Ranger District. Many stands of POC on the Klamath NF are greater than 300 years in age, with some individuals reaching ages of over 700 years. There are three locales within the Siskiyou Wilderness where POC and Alaska yellow cedar are found in very close proximity.

Oregon Caves National Monument (FS)

POC is the dominant tree on approximately 40 acres of the 480-acre Monument, and occurs in stands in about half the Monument. There is no PL in the Monument but it is surrounded by it, even upslope. There are foot trails coming to the Monument from adjacent infested FS lands that are used by people and, illegally, by horses.

Redwood National and State Parks

Of the 110,000 acres in the Park, naturally-occurring POC occupies only about 200 acres at the north end of the Park in the Smith River drainage near Jedediah Smith State Park. POC is found in various pockets generally as a component of stands, but also within a few POC-dominated stands. There are few infestations of PL, with one infestation notably along a main trail. There is no formal public access to other infestations, and generally little access to uninfested stands, except at Jedidiah Smith State Park Campground.

Biscuit Fire

The Biscuit Fire, located within this region, began on July 13, 2002 and reached 499,965 acres (471,130 acres in Oregon and 28,835 acres in California). Estimated to be one of Oregon's largest fire in recorded history, the Biscuit Fire encompassed most of the Kalmiopsis Wilderness. The boundary of the Biscuit Fire stretches from 10 miles east of the coastal community of Brookings, Oregon, south into northern California, east to the Illinois Valley, and north to within a few miles of the Rogue River.

Private Lands

There are 2,000 to 5,000 acres of non-Federal POC in California (see discussion of California early in this chapter). This includes lands in both the Siskiyou and Disjunct California Regions.

Disjunct California Risk Region

Scattered populations of POC grow in this region in the southeastern corner of the Klamath Mountains and Scott Mountains. The primary trees in this part of the region are Jeffrey pine, ponderosa pine, White fir, and Douglas-fir. The Federal administrative unit that covers this region is the Shasta-Trinity NF.

Shasta-Trinity National Forest

Approximately 1,150 acres of POC occur on lands managed by the Shasta-Trinity NF. These are located within portions of the disjunct southeast interior POC population. Occurring as small discontinuous groupings of trees, the POC populations on the Shasta-Trinity NF are almost entirely limited to the riparian zones of the Upper Sacramento and Trinity River drainages. Much of this POC occurs in areas under checkerboard land ownership. There are additional sites with POC on privately-owned land, as well as at Castle Crags State Park. The 1,160-acre Cedar Basin Research Natural Area has isolated patches of large POC as a distinguishing feature.

Although there are several areas of POC root disease infestation along the upper Sacramento River from Shasta Retreat (just north of Dunsmuir) to the mouth of Shotgun Creek, only one infestation is present on the Shasta-Trinity NF. This small infestation was discovered in September, 2001 at Scott Camp Creek, approximately 3 miles upstream from Lake Siskiyou.

Port-Orford-Cedar Acreage Data

Geographic Information System

The geographic information system (GIS)-mapped data for POC and PL infestation was developed over the last decade by the various administrative units (Table 3&4-5). On the Siskiyou NF, roadside survey observations, for both healthy and diseased POC locations, were collected and put into GIS in 1992. Intermittent updates have been made since. The theme is composed entirely of estimated locations as seen from roads with geographical areas being estimated for the presence of healthy and diseased POC. The Siskiyou NF Powers District intensively mapped PL infestations using aerial photo interpretation and on-the-ground verification sampling in 2002.

On the BLM districts the FS standards for roadside surveys and aerial photo interpretation with on-the-ground verification sampling were utilized for mapping the presence of POC and the PL infestations. This data was entered into GIS on the three BLM districts in 1998. On the Roseburg and Medford BLM Districts, only the federally-administered lands were generally mapped for PL infestations. At Coos Bay, Federal and private lands within the boundary of the district were mapped for PL infestations. However, the PL infestations mapped on private lands were not field verified and private lands are not included on Table 3&4-5. The Coos Bay BLM District completed an extensive revision of the POC presence data in early 2003. Continual revisions have been made on a project-by-project basis on the Roseburg and Medford BLM Districts. The Roseburg District remapped its PL infestations in 2002.

On the Klamath, Shasta-Trinity, and Six Rivers NFs in California, the healthy POC and PL infestations were estimated using detailed ecological mapping and plant association plot information. Some non-Federal lands have also been mapped.

Biscuit Fire Acres. Of an estimated 95,000 acres of POC within the perimeter of the Biscuit Fire, an estimated 55,400 acres of uninfected POC stands, and 1,400 acres of PL-infested POC stands were assumed killed, based on overlaying the 75 percent top-kill burn intensity map with the pre-fire POC GIS maps. To get a reasonable estimate of current conditions, those acres were removed from all acres displayed in this analysis. This does not mean those acres will not reseed naturally or be replanted. Indeed, 26,000 disease-resistant POC seedlings have been already sown for out-planting within the burn within the next 6 to 18 months. These restoration efforts are expected to begin restoring the total acres of POC back toward pre-fire levels.

On a potentially positive note, the heat from the Biscuit Fire and resultant altered microclimate may have removed PL from some burned areas. Hansen and Hamm (1996) found that after one week, bags of soil and organic matter that had reached temperatures of 104 degrees

Table 3&4-5.—*Geographic information system-mapped Port-Orford-cedar and* Phytophthora lateralis *infestation acreage on BLM and FS, post-Biscuit Fire*

	Congressional Reserves/Administratively Withdrawn		Late-Successional Reserves		Matrix/Riparian Reserves/Adaptive Management Areas		Total		
Risk Regions	Uninfested	Infested	Uninfested	Infested	Uninfested	Infested	Uninfested	Infested	% Infested
Oregon									
North Coast	1,351	220	57,128	6,177	60,209	1,163	118,688	7,560	6
Inland Siskiyou	4,317	87	18,182	1,151	5,060	544	27,559	1,782	6
Siskiyou	18,829	906	62,474	8,536	22,617	3,012	103,920	12,454	11
Total	24,497	1,213	137,784	15,864	87,886	4,719	250,167	21,796	8
California									
Siskiyou	17,188	1,782	10,641	741	3,013	311	30,842	2,834	8
Disjunct California	371		173		598		1,142		0
Total	17,559	1,782	10,814	741	3,611	311	31,984	2,834	8
Total	42,056	2,995	148,598	16,605	91,497	5,030	282,151	24,630	8

F for 4 hours each day no longer supported the pathogen. A low-intensity prescribed burn will achieve temperatures of 200 to 300 degrees C (392 to 572 degrees F). Many areas of the wildfire were much hotter. Based on the literature, there is good potential for this amount of heat to have negative impacts on PL populations. Questions remain about how deep into the soil profile PL goes (depth of roots) and how deep the pulse of heat extends into the soil.

Port-Orford-cedar Map. Map 2 compiles the GIS maps of POC and PL with the Northwest Forest Plan land allocations. PL infestations are shown in red; POC presence is depicted by all other colors—the colors themselves indicate the underlying Northwest Forest Plan land allocation. Areas not colored do not have POC. The map also shows the FS inventoried roadless areas (cross-hatched) and the Biscuit Fire perimeter (heavy dashed line).

Current Vegetation Survey

The FS maintains a National System of Current Vegetation Survey (CVS) sample plots to acquire basic vegetative resource information tri-annually at the regional scale. This information allows resource specialists and others to assess the current vegetation condition and assess changes in the ecosystem, spatially and temporally. BLM in western Oregon maintains inventory plots to the same establishment and remeasurement standard as the FS, in order to be able to combine data sets for landscape, provincial, and regional analysis.

In general, the acquired dataset represents a collection of basic, statistically-designed, and quality-assured vegetation resource measurements. The strength of the survey includes: the ability to set a benchmark of the vegetative condition on NF and BLM lands, providing a basis for change estimation (i.e., trend analysis), and accommodating monitoring through remeasurement.

Data is collected on nested subplot radii within a one hectare (2.47 acre) plot. The plots are located on a 1.7 mile statewide grid and each plot represents approximately 1,750 acres. The plots are divided into 0.2 hectare areas that contain concentric fixed area subplots that vary for each diameter class being sampled. The intensity of 1.7 miles is not usually useful for evaluating minor species such as POC within limited landscapes. In Table 3&4-6, data is compiled only for larger geographic areas. Other survey methods can be used to assess presence of minor species or incidence of forest diseases, and the results of those surveys could be different based on their intensity when compared to CVS.

Similar inventory plots, forest inventory, and analysis (FIA) are maintained on private lands by the research branch of the FS. Forest inventory and analysis inventory data estimates that there are a total of 54,550 acres (standard error 14 percent) of POC on Oregon's private lands with 9,820 acres (standard error 59 percent) of those lands containing dead POC. This estimate is not considered as reliable as the mapping method used for determining infested acreage on Federal lands and shown in Table 3&4-5, but is the only available estimate of Oregon private lands with POC. The inventory plots are considered accurate for displaying individual tree mortality percentages for both Federal and private lands.

Table 3&4-6 provides tree numbers and mortality information from the most current CVS and forest inventory and analysis data in the range of POC. CVS data shows an additional 40 million POC less than 1 inch dbh (diameter at breast height) on Federal lands in Oregon that are not shown on the table.

Table 3&4-6—*Current Vegetation Survey: Summary from Forest Inventory Plots of live and dead POC trees*

Area [1]	Diameter group dbh [inches]	Live trees	Dead trees	% live	% dead
Oregon					
Federal:	1-7	7,826,100	1,074,600	88	12
Coos Bay	7-20	1,618,300	436,100	79	21
BLM/Powers	>20	361,600	159,600	69	31
Ranger District [2]					
Federal:	1-7	5,863,900	239,100	96	4
other than above [3]	7-20	1,428,500	417,300	77	23
	>20	435,100	138,200	76	24
Total Federal [4]	1-7	13,690,000	1,313,700	91	9
	7-20	3,046,800	853,400	78	22
	>20	796,700	297,800	73	27
Private [5]	1-7	11,767,200	8,722,200	57	43
	7-20	2,134,400	1,631,000	57	43
	>20	102,900	263,200	28	72
California					
Federal [6]	1-7	4,677,000	23,400	99	1
	7-20	1,096,000	4,800	99	1
	>20	379,600	5,600	99	1

[1] Oregon Federal lands were grouped to match "risk regions" described in the Pathology section and lumped to provide statistically significant results.
[2] Standard error 19-33%.
[3] Standard error 18-41%.
[4] Standard error 13-24%.
[5] Standard error 7-115%; these are from FIA plots [see text].
[6] Standard error not calculated.

Aerial Mortality and Defoliation Surveys — Oregon

The State of Oregon, Department of Forestry, and USDA-FS have been jointly conducting aerial sketch mapping of forest insects and disease pathogens for more than 50 years. The survey protocol identifies clumps of at least five dead trees that have been killed within last year and assigns a causal agent. In 2001, the survey system began using real-time global positioning to digitally construct its electronic maps (USDA-FS and Oregon Department of Forestry 2002). The aerial survey observations for southwestern Oregon contain POC root disease as one of the causal agents in its report. Table 3&4-7 summarizes POC root disease results for 2000 through 2002.

Resource Elements That Address Issues

Introduction

With the identification of the Purpose and Need in Chapter 1, and following scoping, a list of issues was developed upon which a decision to select one of the Alternatives would be based. These issues are addressed in the various resource topic discussions in this chapter. These

Table 3&4-7.—*Summary of aerial mortality and defoliation survey results for Port-Orford-cedar in Oregon, 2000–2002*

	2000		2001		2002	
Land ownership	Acres	Dead trees	Acres	Dead trees	Acres	Dead trees
Bureau of Land Management	87	64	123	89	169	70
Forest Service	480	239	257	182	213	74
Private	4,615	4,779	5,835	4,882	5,522	6,963
State of Oregon	1	1	64	58	43	43
Wilderness/National Monuments	68	28	0	0	24	5
Total	5,251	5,111	6,279	5,211	5,971	7,155

discussions cover the ecological, Tribal, and product uses or functions potentially affected by POC management, and provide the basis for the Comparison of Alternatives in Chapter 2.

The issues are affected by two distinct kinds of effects. First, to the extent the standards and guidelines themselves have a direct effect on access or use of the forest and the harvest of forest products, there is a direct effect. Direct effects include potential reductions in non-POC timber harvest because of direct prohibitions in certain areas or stands; reductions in POC bough harvest because of direct prohibitions, and reductions in recreation opportunities because of road closures or prohibitions on off-highway vehicle use.

Second, to the extent that application of the standards and guideline maintains POC, there is a secondary effect on related resources. Such effects include the degree to which stream shading is maintained or lost, thereby changing temperature, wildlife habitat changes related to the loss of future snags, genetic resources retained, or visual resources affected. Both of these kinds of effects are described in the specific resource Effects of the Alternatives sections.

The keystone for the secondary effects analyses is the Pathology section. The available science and experience has been summarized and synthesized, and brought to bear on the various elements of each alternative. The result is a 100-year infection percentage estimate for each of the alternatives. These percentages, which vary for different "risk regions" within the planning area depending upon various risk factors, are converted to acres and used to predict secondary effects.

Pathology

Introduction

POC root disease is caused by the pathogen *Phytophthora lateralis* (abbreviated in this document as PL). PL is an oomycete belonging to the family Pythiaceae. Formerly considered to be true fungi, it is now generally accepted that oomycetes constitute a separate kingdom from the fungi (Cavalier-Smith 1986; Dick 1995; Erwin and Ribeiro 1996; Parker 1982).

All *Phytophthoras* exist primarily as hyphae, or thin threads of fungus-like material adjacent to and within their host. Aggregations of hyphae are known as mycelia. Mycelia, if fragmented or transported along with pieces of the host plant, can serve to move the pathogen to new locations. Mycelia are somewhat fragile and die when exposed to drying conditions. Several spore types form as specialized structures attached to *Phytophthora* mycelia. Although there are four spore types identified for PL, two are important enough in disease spread to be discussed here.

When PL is mature, and generally in the presence of free water, zoospores are released. Zoospores lack cell walls, are very delicate, and have two flagella. They can swim for several hours before forming cysts, but can only travel an inch or two in standing water (Carlile 1983). Zoospores also have the ability to detect compounds released by a host and swim in the direction of the host. Upon contact with a host rootlet, the zoospore will attach itself and germinate. If a host rootlet is not found, other surfaces are contacted, or agitation occurs, a zoospore will form a cyst. When encysted, it can be carried considerable distances in running water. In contact with a host, the cyst can germinate and form a mycelium that infects the host, or it can form a sporangium and release more zoospores.

Chlamydospores are thick-walled vegetative spores. Chlamydospores are somewhat resistant to drying and temperature extremes. They can germinate directly and form infective mycelia or, in the presence of water, they can form sporangia and release zoospores. Ostrofsky et al. (1977) showed that, under laboratory conditions, PL populations detected by baiting (intentionally planting POC seedlings around infected trees) decreased substantially when unfavorably warm, dry conditions typical of summer months in the range of POC occurred. However, the pathogen survived at a reduced level as chlamydospores in organic matter, especially in small roots on infected trees and fragments of roots in the surrounding soil. Hansen and Hamm (1996) have demonstrated that PL can survive in infected POC roots and root fragments for up to 7 years under favorable conditions. PL chlamydospores are incapable of direct movement, but their structure provides protection during passive movement in infected roots or organic material in soil and mud.

Affected Environment

How the Pathogen Spreads

Phytophthora lateralis (PL) spreads in several ways (Hansen et al. 2000; Zobel 1985):

1) Over long distances via resting spores transported in infested plant material or soil;
2) locally via waterborne spores moving in ditches, streams, or overland flow; or
3) via mycelia growing across root contacts and grafts between infected and uninfected POC.

Initiation of infestation into new areas involves 1, above, which is most commonly associated with deposition of infested soil along a road or trail. Vehicles, equipment, animals, or humans on foot transport inoculum from previously infested areas (Hansen et al. 2000; Jules et al. 2002; Kliejunas 1994; Roth et al. 1972). A susceptible POC fairly close to the actual site where inoculum is deposited is essential—this is usually a POC growing close to the road (within 10 feet) or a cedar with its roots in the water along the first 50 feet of a stream in a case where the introduction involves deposition of inoculum directly in water. In addition to

POC, Pacific yew is infected by PL on infrequent occasions (Kliejunas 1994). Observations and laboratory trials show that Pacific yew is much less susceptible than POC. Where it has been found infected, Pacific yew was growing in close association with many previously infected POC (Murray and Hansen 1997).

Once PL is successfully established, subsequent spread mostly involves number 2 listed previously. Under proper environmental conditions for the pathogen, spores produced on the initially infected POC are released and move downslope in overland water flow or streams, infecting additional trees whose roots are within the sphere of influence of the infested water (Hansen et al. 2000; Jules et al. 2002).

Root to root spread, number 3 listed previously, occurs in some cases (Gordon and Roth 1976), but is thought to be of much less significance in the epidemiology of the pathogen than spore spread in soil or water. It occurs in heavily stocked stands with substantial POC components (many POC quite close together).

Infection by PL is greatly favored by cool conditions and requires the presence of water around POC roots for at least several hours (Zobel et al. 1985). Optimal temperatures for infection are between 50° and 68° F (Trione 1974). Most POC are infected by the pathogen in the cool, wet parts of the year. Very little infection occurs in the dry, warm summer months.

Certain kinds of sites and microsites foster conditions especially favorable for spread and infection by PL (Goheen et al. 1999; Hansen et al. 2000; Roth et al. 1987). These high-risk sites are low-lying wet areas (infested or not) that are located downslope from already infested areas or below likely sites for future introductions, especially roads. They include streams, drainage ditches, gullies, swamps, seeps, ponds, lakes, and concave low-lying areas where water collects during rainy weather. Areas not influenced by the wet conditions or periodic water flow that occur in high-risk sites are low-risk sites. Cedars near streams or bodies of water whose roots do not extend below the high water mark for flooding are at low risk of infection. Riparian Reserve widths along a stream (as defined in the Northwest Forest Plan by site tree heights) often extend well beyond the high-risk widths for POC.

Probability of Long Distance Spread and Establishment of *P. lateralis* in New, Previously Uninfested Areas

As already mentioned, long distance spread of PL involves movement of resting spores. These spores can survive in infected POC roots and root fragments in the soil for as long as 7 years after the host POC's death under ideal conditions (Hansen and Hamm 1996). Movement of spores with transport of nursery stock in infested soil was probably how PL was originally introduced into the natural range of POC (Roth et al. 1957). Long distance spread in the forest today primarily involves movement of resting spores in soil adhering to vehicles or clinging to the feet of humans or animals.

When evaluating the likelihood of long distance spread to and establishment of PL in a new area, we need to consider the probabilities that: (1) viable inoculum will be picked up at an infested source; (2) the inoculum will be carried to a particular uninfested area; (3) the inoculum will remain viable during transit; (4) the inoculum will be deposited in the new site; and (5) the inoculum deposited will infect a POC and disease establishment will result. A number of factors influence inoculum accession, spread, and establishment of PL, especially:

- Character of site of origin;
- type of carrier;
- time of year of transport event;
- distance traveled and associated time elapsed;
- effectiveness of management techniques applied to slow or prevent spread or prevent establishment of PL in new areas;
- character of site and stand conditions where the potential introduction occurs; and
- number of potential transport and introduction events.

Exact figures for determining the influence of each factor on the probability of long distance spread and establishment are available in very few cases. However, relative probabilities between 1 (very low) and 10 (very high) have been determined for each factor. Based on the literature, and the professional judgments of forest pathologists with substantial amounts of experience evaluating PL in the laboratory and the field, it is suggested that probabilities of an event having the result under consideration are as follows.

1 = 0 to 2 percent	6 = 10.1 to 20 percent
2 = 2.1 to 4 percent	7 = 20.1 to 30 percent
3 = 4.1 to 6 percent	8 = 30.1 to 40 percent
4 = 6.1 to 8 percent	9 = 40.1 to 50 percent
5 = 8.1 to 10 percent	10 = 50.1 to 100 percent

The following is a discussion of each of the factors:

Character of site of origin. Potential carriers of PL entering a possible inoculum source area are more likely to pick up soil that contains viable inoculum in some kinds of sites than others. Inoculum clearly will not be available on a site with no infection while areas with obvious infection of POC where certain kinds of wet conditions prevail are the most likely places for inoculum to be acquired. Suggested probability figures for the likelihood of potential carriers picking up viable inoculum on different kinds of sites are:

Site with no evidence of root disease within the local drainage = 1;

site with no evidence of root disease in the area entered by the potential carrier but evidence of root disease nearby (within 300 feet) in the same drainage = 2;

site with local evidence of root disease where the potential carrier does not enter water = 5;

site with local evidence of root disease where the potential carrier enters flowing water = 7; and

site with local evidence of root disease where the potential carrier enters a swamp, seep, or any-sized body of standing water = 10.

Type of carrier. Vehicles (both motorized and nonmotorized), equipment, humans on foot, and animals (especially cows, horses, and elk) have been implicated in carrying PL. Probability of successful spread is greater with the larger carriers, those that transport greater amounts of soil, those most likely to access infested areas, and those that can rapidly travel to new sites. Suggested figures for the probabilities that different kinds of carriers could pick up and transport infested soil are:

Earth moving equipment = 10;
large transport equipment = 9;
all-terrain vehicles = 8;
passenger vehicles = 7;
humans on foot or using nonmotorized vehicles = 5; and
large animals = 5.

Time of year of transport event. Likelihood of acquiring inoculum, successfully transporting it, and establishing disease at a new site are greatly favored by cool temperatures, and probability of infection is much greater during wet periods than dry ones. Also, inoculum is most likely to be picked up from an infested site during a wet period when infested soil is muddy and prone to adhere to the carrier. Probability of spread and establishment of new infections is greater with soil movement in late fall, winter, and early spring than summer, and is greater in rainy rather than dry weather. Suggested probability figures are:

Movement between October 1 and May 31 during wet weather = 10;

movement between June 1 and September 30 during dry weather = 1;

movement between October 1 and May 31 during a dry period that lasts at least a week before and continues during the time of the movement = 3; and

movement between June 1 and September 30 during a rainy period sufficient to form puddles on a road or cause roadside ditches to flow = 6.

Distance traveled by carrier. Probability of successful delivery of viable inoculum from one site to another decreases with distance traveled and associated time elapsed since inoculum was picked up. Suggested probability figures are:

For vehicles, less than 0.5 mile = 10;
0.5 to 1 mile = 9;
1 to 5 miles = 8;
5 to 10 miles = 5;
10 to 20 miles = 3;
20 to 50 miles = 2;
greater than 50 miles = 1.

For animals and human foot traffic, less than 0.5 mile = 4;
0.5 to 1 mile = 2;
greater than 1 mile = 1.

Effectiveness of management techniques applied to prevent spread or prevent establishment of *P. lateralis* in new areas. A number of management techniques are recommended for preventing spread of PL or protecting uninfested areas (Betlejewski 1994; Goheen et al.

1997; Goheen et al. 1999; Hadfield et al. 1986; Hansen et al. 2000; Hansen and Lewis 1997; Kliejunas 1994; Roth et al. 1987). Techniques that can be used and suggested probabilities associated with each include:

Exclusion — This involves protecting uninfested areas by excluding vehicle entry. It can be done by permanently closing existing roads and/or by not building roads into uninfested drainages or upper portions of drainages. Cross-country travel or trail use by animals or humans on foot or in off-highway vehicles can still result in introductions, but probability is low, especially if the distance to the closest infested area is greater than 1 mile. The suggested probability figure if this management approach is used is 1.

Temporary road closure — This involves closing roads with gates or barriers to regulate timing and amount of use. Roads are closed when weather conditions are favorable for PL spread and may be open during other seasons of the year. Gates can be driven around, forced open, or destroyed by vandals, but most remain intact and prevent road use. In a sampling of gated closures done by the Southwest Oregon Forest Insect and Disease Service Center in November of 2000, 90 percent were intact and apparently effective in preventing entry (unpublished data). The suggested probability that a currently uninfested area will be protected if this management approach is used is 2.

Washing — This involves washing vehicles used in projects to remove infested soil before they are moved out of an infested area or before they are moved into an uninfested area. In some instances, tools and boots are also washed. One case study has demonstrated that normal washing can remove most of the inoculum on a vehicle or worker's feet (Goheen et al. 2000). Level of viable inoculum was reduced 92 percent by washing of a road grader, 91 percent by washing of a pickup truck, and 96 percent by washing of a worker's boots. Limitations on washing include the possibility of picking up new inoculum on an infested road after washing and the inability of the Agencies to require vehicle washing of numerous vehicles that use the roads but are not controlled by the Agencies. The suggested probability figure if this management approach is used by itself is 4.

Roadside sanitation — This treatment involves removing POC in buffer zones along both sides of roads. Objectives are either to (1) eliminate or minimize the amount of inoculum readily available for vehicle transport from already-infested roadsides, or (2) prevent/reduce new infections along roadsides in currently uninfested areas. The basis for this kind of treatment is the fact that PL only infects living POC roots (Zobel et al. 1985). PL can survive for a time in already infected roots after a POC dies, but it cannot colonize the roots of already dead POC. The objective of the treatment is to create a zone along roads where live POC roots are absent. Preliminary results from an analysis of roadside sanitation treatments being done by the Southwest Oregon Forest Insect and Disease Service Center (Marshall and Goheen 1999) show sanitation treatments reduce the amount of inoculum available for transport when done along infested road sections. Some decrease in inoculum was observed within 1 year of treatment while statistically significant declines were observed 3 years or more after treatment (after 3 years the amount of inoculum on average was reduced by 60 percent). The suggested probability figure to decrease inoculum if this management approach alone is used on already infested roads is initially 8, dropping to 5 in 3 years after the treatment. Probability can increase again if roadsides are not monitored and treated again if POC regenerates on the site. However, if POC exclusion is successfully carried out, the probability drops to 1 after 7 years. Use of sanitation treatments at probable introduction sites in uninfested drainages has not been evaluated. However, if all cedar are removed from roadsides before any inoculum is deposited, it seems reasonable that probability of establishment of the pathogen in the roadside area should be substantially reduced, perhaps to a probability figure of 2.

Integrated management — Employing a planned combination of treatments can reduce probability of long distance spread more than single kinds of treatment. An integrated treatment program that uses a combination of sanitation treatments, vehicle washing treatments, road drainage improvements, timing of activities during dry seasons, using certified clean or Clorox-treated water, scheduling treatments in uninfested before infested areas, regulation of special use activities such as cedar bough collecting, and public education efforts has a suggested probability of 3. If such treatments are combined with road closures, the suggested probability is 1. Probabilities with an integrated management approach would be slightly higher in situations where some of the management techniques could not be used (for example, in a situation where a large wildfire was burning and safety and suppression success considerations prevented use of some of the techniques that might normally be used).

Character of site and stand conditions where the potential introduction event occurs. Introduction of inoculum and establishment of disease in a new, previously uninfested site is influenced by site characteristics as well as occurrence, numbers, and distribution of POC. If carriers deposit viable inoculum on a wet site with POC nearby, and when there are numerous additional cedars downslope in high-risk sites, probability of disease establishment is high. Clearly, depositing inoculum in sites with no POC and no mechanism for moving the inoculum to any POC is low (1). When inoculum is deposited along a road, probability is highest when there are wet conditions and at least some POC within 10 feet (8). When cedars occur more than 10 feet from the road, but less than 50 feet away, predicted probability drops to 4. When inoculum is introduced directly into water at a stream crossing or ditch, probability of establishment is high (8) if there are POC with their roots in water downstream within 50 feet. For similarly situated POC between 50 and 100 feet from the road, probability would be 4. Jules et al. (2002), in their dendrocronological study, indicated that there was evidence of initial infections well beyond 160 feet down a stream; however, by the nature of their study, they were unable to evaluate small trees that had died many years before and were no longer detectable on the sites. It is possible that what they viewed as a single spore infection event actually was a several-stage event initially involving small trees closer to the road. We suggest a probability of 2 for potential introductions in stream crossings if there are no POC in the first 100 feet, but cedars do occur in the subsequent 500 feet.

Number of potential transport and introduction events. The probability figures provided above can be used together to evaluate the relative likelihood of various long distance PL spread/establishment scenarios involving individual potential carriers. Number of potential transporting events should also be taken into account when evaluating possibility of new introductions. Very low probability events become more likely to occur when they are repeated, and especially so if they are repeated many times.

No formula is suggested here for ranking activities or projects, although the general relationships could be used to help guide future site-specific analyses, including use of the POC Risk Key that is a part of Alternatives 2 and 3 in this SEIS. The concepts described above, coupled with known levels of activity (see Background and various Affected Environment sections), conditions on surrounding lands, and other factors described in the SEIS and its references, were designed to serve as part of the analysis needed to make predictions about disease spread for the alternatives considered in this SEIS.

Disease Progression Once the Pathogen is Introduced

Figure 3&4-1 shows the progression of POC root disease within a drainage after PL is introduced and becomes established.

The curve is a disease epidemic curve similar to those of many other plant diseases (Van der Plank 1975). PL is introduced at time 0. At least one POC is infected as a result of the introduction which involves infested soil falling off a vehicle or the feet of an animal or human.

Rate of disease increase is low at first (area *a* on diagram); there are relatively few spores produced because only one or a very few POC close to the site of introduction are infected. Inoculum production increases as more POC are infected (area *b* in diagram). Spore levels in water flowing downslope in drainages during the wet season and in streams increase to high levels. POC trees on high-risk sites downslope from the source of introduction are exposed to this inoculum, are infected, and produce more inoculum in turn. This leads to rapid spread and high levels of mortality of a large proportion of POC growing in the high-risk sites.

Eventually, amount of new mortality and rate of spread within the drainage decreases substantially (area *c* on diagram). Most original POC on the sites with characteristics favorable for the pathogen have been infected and killed by this time. Spread to POC growing on unfavorable sites is very slow and sporadic if it occurs at all (when it does happen it typically involves animals or humans moving infested soil directly onto the roots of individual POC trees during cool, rainy weather). Inoculum levels often remain high on the high-risk sites due to reseeding of POC and chronic infection of small trees.

Percent of trees infected at various points in Figure 3&4-1 are:

Stage	Time	% trees infected
a	2–10 years	<0.1
b	5–20 years	90 (high-risk sites)/0.1 per year (low-risk sites)
c	>20 years	Chronic infection/regeneration (high-risk sites)/0.1 per year (low-risk sites)

There are substantial differences in PL spread and impacts within infested drainages in different parts of the range of POC. These mainly reflect (1) different distributions of POC across the landscape in different areas; (2) different proportions of sites in different areas that have conditions favorable for spread and infection by PL (high-risk sites); (3) different histories of PL occurrence; and (4) different positions on the disease progression curve in different areas. Differences by major area or “risk regions” are discussed as follows.

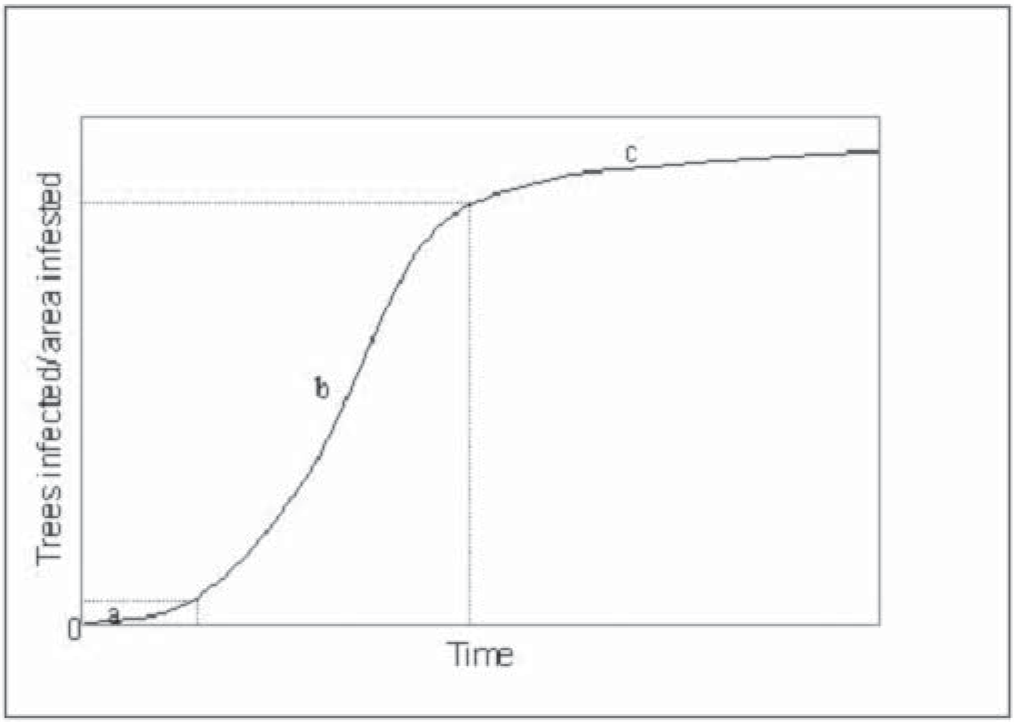

Figure 3&4-1.—*Progression of Port-Orford-cedar root disease within a drainage after* Phytophthera latralis ***is introduced and becomes established***

North Coast Risk Region (Northern/Coastal Portion of Range: Powers Ranger District, Siskiyou NF, and Coos Bay BLM District). POC is distributed widely across the landscape. On average 20 percent of the area is comprised of high-risk sites. The pathogen has been present in this area for considerable time. Mapping and forest inventories indicate that about 15 percent of the area (or 75 percent of the 20 percent in high-risk sites) is infested, and most drainages are at level *c* on the disease progression curve. Most originally-occurring cedars in infested high-risk sites have been killed (general estimate is 90 percent). There is chronic mortality of small cedars regenerating on high-risk sites that are infested. Low-risk sites (80 percent of the area) are little impacted. Non-Federal lands near Coos Bay contain approximately 8,500 acres of non-roadside infection and represent a chronic source of PL for export to Federal and other lands here and throughout the range.

Siskiyou and Disjunct California Risk Regions (Southern Portion of Range on NFs: other districts on Siskiyou NF and districts on the Six Rivers, Klamath, and Shasta-Trinity NFs). POC occurrence is much more tied to riparian zones and wet areas here than is the case in the northern part of the range. On average about 40 percent of the area is in high-risk sites. PL has not been present in this part of the range for as long as it has been further north. Mapping and forest inventories indicate that about 9 percent of the area (or nearly 25 percent of the 40 percent in high-risk sites) is infested. A substantial number of drainages or the upper parts of drainages have not had introductions of the pathogen. Some infested drainages, including major ones in the south, are still at level *b* on the disease progression curve and exhibit high levels of current infection. Ultimately, the amount of mortality in infested high-risk sites is predicted to reach the same levels observed in the northern part of the range. Some drainages are even at area *a* on the disease curve such as the Lower Sacramento River and Scott Camp Creek drainages where PL infection has only been recently observed. These too will suffer high levels of mortality in high-risk sites unless eradication treatments prove successful.

Inland Siskiyou Risk Region (inland portion of Range in Oregon, Medford, and Roseburg BLM Districts). The discussion for this area is similar to that for the southern part of the range on FS land, except that on average about 60 percent of this area is in high-risk sites (the larger number reflects contribution of higher road density to risk coupled with the occurrence of POC here being mostly tied to creeks and wet areas). Position of infested drainages on the disease progress curve are divided between *b* and *c*.

Effects of Alternatives

Introduction

PL does not threaten POC with extirpation. In fact, considerable areas within the range of POC are on low-risk sites or in drainages that remain uninfested. Some estimates of current proportion of area within the range of the POC on Federal lands where uninfected POC occur include 91 percent from the mapping exercise done by the FS and BLM for the recent POC range-wide assessment, 89 percent for FS lands in California based on plant association mapping (Jimerson data), and the same figure for CVS data, and 76 percent for large trees based on inventory data for Federal lands in Oregon (from Table 3&4-6).

There is little spread of PL on low-risk sites even when the pathogen is already established nearby. It is estimated that on average 0.1 percent of the cedars on low-risk sites are infested per year in infested drainages. In most situations, additional cedar regeneration and/or growth of other, uninfected cedars more than offsets this loss in POC trees. Data suggest that 80 percent of the area in the northern coastal portion of POC range, 60 percent in the southern part of the range, and 40 percent in the inland portion of the range are in low-risk sites.

PL does indeed have major effects in high-risk sites, especially in streams and riparian areas. Within these areas that are especially favorable for spread and infestation by PL, it is estimated that on average 90 percent of the POC present before introduction are killed by the pathogen, usually in only a few years after the pathogen is established (5 to 20 years; usually closer to the shorter end of this range). Data indicates that 20 percent of the area in the northern coastal portion of POC range, 40 percent in the southern part of the range, and 60 percent in the inland portion of the range are in high-risk sites. Large cedars are especially prone to infection and mortality on these sites. Natural reseeding maintains POC at some level on many of these sites, but chronic infestation insures that few if any of the cedars regenerating on a high-risk site after it is infested attain large size.

To maintain POC in high-risk sites requires either:

1) Excluding PL from being introduced into the area in the first place;

2) deployment of disease resistant POC planting stock (this will replace large trees only after many years); or

3) reestablishing cedar after eradicating PL from infested sites (a difficult and problematic approach that also results in the loss of the large cedars at the time of treatment).

Port-Orford-Cedar Root Disease and the Alternatives Considered in the SEIS

Low-risk sites. The influence of POC root disease on low-risk sites is likely to be similar under all of the alternatives being considered in the SEIS. Hosts on these kinds of sites will suffer 0.1 percent per year disease-caused mortality. The few trees that are infected and killed each year will be spread among all diameter classes and will be replaced by new POC regeneration and/or growth of nearby surviving POC. It is predicted that there will be little or no change in disease occurrence and expression in the next 100 years on low-risk sites regardless of which alternative is selected. This would be consistent with what has been observed on low-risk sites in the first 50 years of the disease's occurrence in the natural range of POC.

High-risk sites. In contrast, establishment, spread, and effects of the root disease on the existing POC in high-risk sites that have not yet been infested is likely to differ substantially with alternative chosen. When PL is established in a formerly uninfested drainage or portion of a drainage, rapid disease spread and 90 percent mortality of the existing POC growing in downslope high-risk sites can be expected in the subsequent 5 to 20 years.

While it is impossible to give a precise figure of the proportion of today's uninfested drainages or drainage portions that will become infested with selection of each of the 5 alternatives, consideration of the factors and circumstances discussed above permit estimates of infestation rates for the next 100 years (Table 3&4-8).

The following assumptions were made in arriving at these estimates:

1) PL will continue to act as it has in the first 50 years of its presence in the range of POC.

2) The same kinds of spread scenarios and the same kinds of associated transport and establishment probabilities will exist in the next 100 years.

3) Overall activity levels in the forest by humans and animals will remain similar to the levels of today (though there probably will be shifts in the relative levels associated with different kinds of activities).

4) The Federal agencies will continue to be involved in a variety of management activities on the lands they administer (though the proportions of Federal projects in different categories may change).

5) The de facto protection provided by reserve and other land allocations on Federal lands will remain in place.

6) Private forest lands within the range of POC will continue to be managed primarily for forest products.

7) Few significant attempts will be made to limit spread and intensification of PL on private lands.

Table 3&4-8.— *Percent of currently healthy drainages (uninfested high-risk areas) predicted to become infested within 100 years by alternative*

Alternative	% uninfested high-risk areas to become infested
1	40
2	35
3	20
4	80
5	80

Rational for 100-year infestation predictions made for each alternative follow.

Alternatives 4 and 5

These alternatives have the highest estimates for future infestation of high-risk sites within the area covered by the SEIS (80 percent in the next 100 years). These alternatives have no provisions for reducing the spread of PL on Federal lands and are thus the least likely of the alternatives to slow introduction and establishment of the pathogen on currently uninfested high-risk sites. Though it is likely that timber harvest, other extractive activities, new road building, and miles of drivable road will decrease in the next 100 years on Federal lands when compared to the past 50 years, Federal management projects that involve vehicle transport and use of machinery will still be done at levels described in the Northwest Forest Plan, and a substantial number of roads will be maintained. Timber harvesting and related activities will continue on private lands and will influence PL spread on Federal lands, especially those that are near to or interspersed with the private lands. Recreational use of the forest is likely to increase substantially with increased populations. Also, use by entrepreneurs interested in special forest products will likely increase. Many recreationists and forest products entrepreneurs are very mobile, readily use roads of low standards as well as improved roads, and sometimes employ off-road vehicles to travel into areas where there are no roads at all. Others travel into areas away from roads on foot. Under Alternatives 4 or 5, no actions will be taken by Federal managers to prevent pick-up of inoculum at already infested sites or along travel routes by any forest users, nor will actions be taken to prevent entry into uninfested areas.

During the first 50 years of PL's presence in the native range of POC, the pathogen infested about 36 percent of the high-risk sites in all of the area under consideration in this SEIS. It infested about 75 percent of the high-risk sites in the northern coastal part of POC's range closest to where the original introduction of PL occurred. All spread subsequent to PL's introduction was from closely associated sites near Coos Bay at the northwestern edge of the host's range. During the last 25 years, there were numerous attempts to retard spread and intensification through disease-management activities on many Federal lands. In the next 100 years, a period twice as long as our 50 year experience of the past, spread will be from numerous infested areas already distributed widely across the area covered by the SEIS. In Alternatives 4 and 5, it is estimated vehicle transport of PL will be similar to or increase from what it has been in the past, though it will involve different kinds of vehicles in many cases. Spread into currently uninfested areas would be substantial in the next 100 years, though not all uninfested areas would be affected. It is predicted that most of the remaining uninfested high-risk sites in 100 years under either of these alternatives (estimated as 20 percent of those existing today) will be located in unroaded remote areas where land allocations prevent or strongly discourage entry by vehicles.

Alternative 3

This alternative has the lowest estimate for future infestation of high-risk sites of the alternatives included in the SEIS (20 percent in the next 100 years). This alternative includes a risk key to consistently determine where site-specific management practices should be applied to reduce the risk of PL spread. These would include roadside sanitation, vehicle washing, scheduling activities during dry seasons, road closures, and public education, among other activities. These activities are effective to various degrees in reducing probability of picking up and transporting PL inoculum, especially when used together in integrated strategies. Education, as well as road closures and sanitation treatments applied strategically, will affect the component of future spread involving increased public use of the area within the range of POC in the next 100 years. This alternative also includes additional measures for POC stands (core areas) and surrounding buffers in 32 uninfested 6th field watersheds. Road occurrence and use and earth-disturbing activities would be reduced, or eliminated altogether, in POC cores and buffers.

Though it provides considerable protection, there is still a probability that in some cases PL could be spread into currently uninfested watersheds under Alternative 3. Even in the uninfested areas provided maximum protection with the POC core and buffer system, there is a probability, albeit low, that PL can be introduced by animals or human foot traffic or vehicles. The introduction of PL into the Little Chetco River in the Kalmiopsis Wilderness provides an illustration from the past of disease spread into an unlikely remote area. In uninfested sites not located in the 6th field watersheds with POC cores and buffers, the risk key should lead to implementation of an appropriate set of management practices to reduce the likelihood of introduction. Also, the risk rating system will be used in planning agency activities and projects. But no management technique is 100 percent effective (see probabilities in section on long distance spread of PL). In situations where no projects or activities are being planned in an area, use of roads by the public or other entities not controlled by the Federal agencies (in checkerboard ownership, for example) may not have been considered in the risk key and thus, lack treatments. Even where the risk key is used on Federal lands near or especially interspersed with private timber lands, there will likely be more inoculum than in block ownerships. Some kinds of management activities such as roadside sanitation and vehicle washing will be less effective in reducing probability of spread in these cases then would be the case in areas where the agencies have block ownerships. It is estimated that sanitation and vehicle washing would influence likelihood of long distance spread less than a quarter as much along roads in “checkerboard” ownerships than in areas where all the land is managed by the agencies. Treatments would be most likely to affect long distance spread if done along roads leaving areas of mixed ownership.

Alternative 2

This alternative has an estimate for future infestation of high-risk sites within the area covered by the SEIS (35 percent in the next 100 years) that is higher than that for Alternative 3 but much lower than those for Alternatives 4 or 5. This alternative has provisions for limiting spread of PL through consistent use of the same risk key described under Alternative 3. Alternative 2 has a somewhat higher estimate of future infestation of uninfested high-risk areas than Alternative 3 because it lacks the additional management direction for the 32 currently uninfested 6th field watersheds in Alternative 3. Under Alternative 2, management practices in these large uninfested areas would depend only upon results of using the risk key.

Alternative 1

Alternative 1 has an estimate of future infestation of high-risk sites within the area covered by the SEIS (40 percent in the next 100 years) that is slightly higher than Alternative 2 but is still considerably lower than Alternatives 4 or 5. This alternative retains the current management direction. Like Alternatives 2 or 3, it also emphasizes use of various management practices effective in reducing probability of spread of PL but instead of the risk key, it depends on project specific analyses to determine appropriate treatments. Its higher risk estimate reflects a less consistent analysis approach than that expected to be provided by use of the risk key in Alternatives 2 and 3.

Alternatives 1, 2, 3, and 4 to a greater degree, and Alternative 5 to a lesser degree, have provisions for deployment of PL-resistant POC planting stock. The first four alternatives also emphasize resistance breeding to varying degrees with Alternative 4 especially stressing an accelerated breeding effort. If POC stock with durable, long-term resistance becomes available, high-risk sites where most of the cedar has been killed in the past as well as high-risk sites that become infested in the future can be replanted with resistant trees. Development and deployment of genetically resistant stock has proven to be a successful method for maintaining hosts on sites favorable for infestation in cases involving other *Phytophthora*-caused plant diseases (Erwin and Ribeiro 1996; Umaerus et al. 1983). Differences in effects of selecting each of the five alternatives on development and deployment of resistant POC are addressed in the Genetics section of this document.

Cumulative Effects

Even though probabilities were low and it was very unlikely to happen, there is evidence that PL has indeed been transported on occasion over particularly long distances (even over 50 road miles) and into areas that were thought to be unlikely candidates for infestation because of their remoteness. Disease establishment in the Little Chetco River in the Kalmiopsis Wilderness, along the Smith River Drainage, Lower Sacramento River Drainage, Potato Patch Creek, and Fish Lake are known examples. The latter three of these occurrences probably involved inoculum carried on vehicles driving or being transported on roads (in the Lower Sacramento River case, a piece of equipment that had been used in Oregon may have been responsible). The Smith River occurrence is believed to have involved travel by vehicle and on foot by cedar bough collectors, and the Chetco River case remains a mystery though it may have been associated with mining activity (dredging).

There is a possibility that a small number of currently uninfested high-risk sites in California may be infested in the future as the result of inoculum transport from Federal lands in Oregon even though the probability is much lower than the probability that new infestations in California could result from inoculum transport within California. The probability of spread from Oregon to California would be low under any of the alternatives considered in the SEIS. It would be higher under Alternatives 4 and 5 than under Alternatives 1, 2, and 3. It is impossible to provide exact figures. However, given the fact that there have been four documented cases of long-distance transmission in California in the last 25 years (Smith

River, Potato Patch Creek, Fish Lake Creek, and the lower Sacramento River), additional long-distance spreads are likely to happen under any alternative, and each will have the potential to open the disease to a large, currently uninfested area.

Long-Term Mortality

Using the percent mortality predictions shown in Table 3&4-8, and the mortality information in Tables 3&4-5 and 3&4-6, the acres and overall percentage of POC expected to survive at the landscape scale can be calculated for each alternative. While the effects of long-term mortality are not evenly distributed over the landscape, and may impact some habitats more than others, it is a useful consideration for some impacted resources. How the calculations are derived from those tables necessitates some explanation. The calculations just include Oregon, since that is the area directly affected by the alternatives.

For comparison of data and further discussions portions of Table 3&4-5 and Table 3&4-6 have been combined into Table 3&4-9.

In this case, the CVS numbers for trees are a more accurate statistical measure of the POC tree population and mortality than GIS. GIS is primarily designed to give spatial representations of data, while CVS is, by design, a population sampling scheme. The GIS maps may suffer from two sources of bias: Smaller (less than 7 inches diameter at breast height) infected trees are difficult to detect on aerial photos in the dense forests on the North Coast; and, mapping in the southeast part of the range is done at stand levels, while POC may be confined to wet areas within the stands. Given some of the inherent overestimates and underestimates of the GIS mapping data, the CVS percent mortality calculation is considered more useful for projecting the long-term POC mortality in each region for each alternative. Using 15 percent mortality for the North Risk Region and 9 percent for the Siskiyou and Inland Siskiyou Risk Regions, assuming this mortality is virtually all on high-risk sites, and applying the pathology predictions contained in Table 3&4-8 to remaining uninfested sites, the following table (Table 3&4-10) can be derived to project long-term POC infestation for Oregon.

The total area predicted to be infested at 100 years varies between 16 and 29 percent (from 12 percent today) depending upon alternative (Table 3&4-10, shaded column). The percent of high-risk areas predicted to be infested in 100 years is also displayed on Table 3&4-10 because some effects, such as water temperature, are dependent more on the percent of PL infestation near streams, not the percent infestation on the entire landscape. The percent of

Table 3&4-9.—*Infested and infection estimates, Oregon*

	Geographic information system [acres]			Current vegetation survey
Risk regions	Uninfested	Infested	% infested	% infected
North Coast	118,825	7,560	6	15
Inland Siskiyou	27,555	1,782	6	9
Siskiyou	103,787	12,454	11	
Total	250,167	21,796	8	

Table 3&4-10.—*100-year infestation prediction for Oregon by alternative*

Alternative	% of risk region high risk	Currently infested high-risk area [as % of risk region] [1]	Uninfested high-risk area [as % of risk region]	% of uninfested high-risk areas predicted to become infested [new] in 100 years [2]	Uninfested high-risk areas predicted to become infested [as % of risk region] [3]	Total [new and current] area to be infested in 100 years [as % of risk region]	Total [new and current] area to be infested in 100 years [in acres] [4]	Total [new and current] area to be infested in 100 years [as % of high-risk areas only]
North Coast Risk Region *[126,248 acres]*								
1	20	15	5	40	2	17	21,450	85
2	20	15	5	35	2	17	21,450	85
3	20	15	5	20	1	16	20,200	80
4 & 5	20	15	5	80	4	19	23,990	95
Siskiyou Risk Region *[116,374 acres]*								
1	40	9	31	40	12	21	24,900	52
2	40	9	31	35	11	20	23,100	50
3	40	9	31	20	6	15	17,690	37
4 & 5	40	9	31	80	25	34	39,330	85
Inland Siskiyou Risk Region *[29,341 acres]*								
1	60	9	51	40	20	29	8,630	48
2	60	9	51	35	18	27	7,880	45
3	60	9	51	20	10	19	5,630	32
4 & 5	60	9	51	80	41	50	14,670	83
Totals *[271,963 acres]*								
1				40		20	54,990	61
2				35		19	52,120	58
3				20		16	43,520	49
4 & 5				80		29	77,930	87

[1] All infestation is assumed to be within the high-risk areas.
[2] From Table 3&4-6.
[3] Previous two columns multiplied together.
[4] Mortality in infested areas is expected to be about 90%; table does not include replacement with resistant stock.

high-risk areas predicted to be infested in 100 years varies between 49 and 87 percent (from 36 percent today), depending upon the alternative (Table3&4-10, last column). In both cases, the 100 year infestation percentage varies by risk region.

Ecology and Plant Associations

Affected Environment

Introduction

POC is found from southwestern Oregon to northwestern California, primarily in the Coast Ranges and Siskiyou and Klamath Mountains, with a small disjunct population in the Scott Mountains of California (Figure 1-1).

The following discussion of the affected environment is organized at two scales: the local scale of plant associations (grouped here for clarity), and the broad landscapes of ecosystems. Organizing affected environments at multiple scales has proven a useful analysis tool, because it more fully captures the range of environmental diversity and ecosystem functions.

Local Scale

Although POC has a narrow geographic range, it occupies many different environments. The species is found at elevations from sea level to 6,400 feet, in glacial basins, along streams, on terraces, and on mountain side-slopes from lower to upper one-third slope positions. POC shows adaptability to a wide range of summer evapo-transpiration stress, from very high humidities along the coast to very low summer humidities inland. Soils where POC is found are derived from many parent materials, including sandstone, schist, phyllite, granite, diorite, gabbro, serpentine, peridotite, and volcanics.

Of these, serpentine- and peridotite-generated soils form a distinct group known as ultramafics. Ultramafics are generally droughty environments distinguished by a soil imbalance of the magnesium-to-calcium ratio—an environment is associated with rare plant species. POC is among the few tree species that can grow on these soils; in some cases it is the only tree species tolerating this peculiar environment.

POC plant associations therefore characterize the broad range of habitats in which POC is found. These plant communities display some of the richest plant species diversity of all forest types in the region (Jimerson and Creasy 1991).

POC can be found with a variety of species with differing ecological requirements. These species differ across the range of POC. For instance, in the northwestern portion of the range, POC is found in association with western hemlock (*Tsuga heterophylla* (Raf.) Sarg.), in the southwest with coastal redwood (*Sequoia sempervirens* (D. Don) Endl.) and tanoak (*Lithocarpus densiflora* (H. & A.) Rehd.), in the central portion with Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco.), and at higher elevations in the eastern portion of its range with white fir (*Abies concolor* (Gord. & Glend.) Lindl.), western white pine (*Pinus monticola* Dougl.), Shasta red fir (*Abies magnifica* var. *shastensis*) and mountain hemlock (*Tsuga mertensiana* (Bong.) Carr.). POC has been noted as a major or prominent component of 90 plant associations in Oregon and California (Atzet et al. 1996; Jimerson and Daniel 1994; Jimerson et al. 1995; Jimerson et al. 1996; Jimerson and Creasy 1997).

The estimate of 306,781 acres of POC occurring throughout its range was derived using GIS mapping of all stands containing POC regardless of stocking level. This section of the SEIS, however, focuses on the 64 plant associations where POC is prominent in the overstory. This includes all POC plant associations (those with POC in their name), and as well as a few others where POC is common. The area covered by these plant associations is approximately 130,000 acres, or about 42 percent of the total mapped POC acres. Unless otherwise noted, discussion in this section covers only those acres.

Ecoregions/Subsections

The wide ecological amplitude of POC is also reflected in the broad ecoregions and subsections in which it is distributed. At this scale, climate and geomorphology, rather than vegetation or soils, are the primary environmental variables used to delineate ecological units (McNab and Avers 1994; Jimerson et al. 2003; Winthers et al. 2003).

Two types of ecological units were used to describe the distribution of POC, level IV ecoregions in Oregon (USEPA 1998) and subsections in California (USDA 1997). These are the lowest division of regional ecosystems mapped in the two states. Ecoregions and subsections are configured and delineated differently because they are based on two different methods of mapping ecosystems. Land use or human disturbance is used as a factor in separating ecoregions (USEPA 1998), while subsections are separated by differences in attributes of the environment (Winthers et al. 2003). The ecoregions and subsections are shown on Map 3 and characterized in the following section. Note in the discussion that follows the ecoregions/subsections have been grouped into six larger geographic areas.

Northern Coast Geographic Area

Mid-Coastal Sedimentary and Southern Oregon Coastal Mountains Ecoregions. The Northern Coast geographic area is composed of the Mid-Coastal Sedimentary and Southern Oregon Coastal Mountains Ecoregions. Part of the Oregon Coast Range, these ecoregions are in low elevation mountains with high rainfall and dense coniferous forests. It has moderately sloping, dissected mountains and sinuous streams. The most important characteristic in terms of species composition is the occurrence of western hemlock as a dominant or codominant species. Ten plant associations with POC were identified in these ecoregions, and five were found only in these ecoregions.

North Inland Geographic Area

Inland Siskiyous and Siskiyou Mountains Ecoregions. The Inland Siskiyous and Siskiyou Mountains Ecoregions together form this geographic area. This area has higher, steeper terrain than the others. The North Inland has a high diversity of conditions, which is reflected in the vegetation. The vegetation is dominated by the Douglas-fir Series at low elevations, Jeffrey Pine Series on ultramafic soils, and White Fir and Red Fir Series at higher elevations. Sixty-two plant associations with POC were identified in this ecoregion and subsection, and many are exclusive or have their greatest extent here.

Mid-Coast Geographic Area

Coastal Siskiyous Ecoregion. This geographic area is located in Oregon and features highly dissected mountains and high gradient streams, as well as a few, small, alpine glacial lakes. The climate is wetter with more maritime influence than elsewhere in the Klamath Mountains Bioregion, but drier than the Northern Coast. This area has tanoak, Douglas-fir, and some POC. Western hemlock is less well represented here than in the Northern Coast. Nine plant associations were identified in this ecoregion that contain POC, with a high frequency of plant associations on serpentine soils.

Mid-Range Geographic Area

The Serpentine Siskiyous/Gasquet Mountain Ultramafics Ecoregion. This ecoregion is dominated by the Tanoak-Port-Orford-cedar Subseries (POC is codominant with tanoak). In Oregon, the White Fir Series and the Port-Orford-cedar-White Fir Subseries are fairly common and occur at relatively high elevations (up to 4,800 feet) and a long distance inland (up to 45 miles). The Port-Orford-cedar-Douglas-fir and Port-Orford-cedar-Western White Pine Subseries are more common in California, the latter being correlated with ultramafic rock. This ecoregion is highly diverse.

The Western Jurassic Subsection. Marine air moderates temperatures in the western portion of this subsection creating a temperate to humid climate. The Douglas-fir and Tanoak Series dominate this subsection. Twenty-two plant associations with POC are described in this subsection, none are found only here. This subsection has the second highest amount of POC of all subsections in Northern California.

Note: In the discussion and tables presented in this document, the Mid-Range and North Inland geographic areas are separated into Oregon and California components so that the effects of the alternatives are more clearly presented.

East Disjunct California Geographic Area

Some of the POC plant associations in East Disjunct California are found nowhere else.

Eastern Klamath Mountains. This subsection is located on the farthest southeastern corner of the Klamath Mountains. It has two plant associations with POC; neither is unique to this subsection.

Lower Scott Mountains. This subsection comprises the low elevation portion of the Eastern Klamath geologic belt of the Klamath Mountains. Ultramafic rocks of the Trinity Terrane and intrusions of granitic rocks dominate the geology of this area. The Jeffrey Pine, Ponderosa Pine, White Fir, and Douglas-fir Series are the dominant vegetation in this subsection. Five POC plant associations are present.

Upper Scott Mountains. This subsection comprises the high elevation portion of the Eastern Klamath geologic belt of the Klamath Mountains. The geology is the same as the Lower Scott Mountains Subsection. Thirteen plant associations with POC are found here, seven are unique to this subsection, and three additional POC plant associations are predominantly found here.

Southern Range Geographic Area

POC occurs only along the border of these subsections with the Mid-Range and North Inland geographic areas.

The Eastern Franciscan. The Eastern Franciscan Subsection represents the high elevation portion of the northern California Coast Ranges. There are 16 POC plant associations in this subsection. None of the plant associations are unique to the subsection, and most are extensions of what is found in the Gasquet Mountain Ultramafics, Western Jurassic, and Siskiyou Mountain Ecoregions and Subsections.

Pelletreau Ridge. This subsection is a narrow, arcuate strip of land along the southwest edge of the Klamath Mountains. POC stands here are 20 miles south and 50 miles west of the nearest other stands of POC, although there are no unique plant associations here. The vegetation in this region is dominated by Douglas-fir and Tanoak Series, with White Fir Series at higher elevations (Miles and Goudy 1997).

Rattlesnake Creek. This is also an arcuate subsection that is within the Western Paleozoic and Triassic Belts of the Klamath Mountains. The Douglas-fir, White Fir, and Ponderosa Pine Series dominate this subsection, with Jeffrey Pine Series on serpentinized peridotite (Miles and Goudy 1997). This subsection has a very small amount of POC. There are no POC plant associations that are unique or reach their greatest extent here.

Ecosystem Functions of Port-Orford-Cedar

Biodiversity is the variety of life and its processes. This section discusses these processes; the next section focuses on the diversity of POC ecosystems.

The 64 documented plant associations with POC as a major component can be grouped by key ecosystem processes (Table 3&4-11). The first useful division is ultramafic versus nonultramafic soils. These can be further divided into riparian (adjacent to watercourses, including ephemeral streams) sites and upland sites. A summary of these plant association groups can be found in Table 3&4-11, and their estimated acreages in Table 3&4-12. Note that *plant association group* here is defined somewhat differently than in conventional plant

Table 3&4-11.—*Number of plant associations containing Port-Orford-cedar by geographic area and plant association group*

	Geographic area						
Plant association group	Northern Coast	Mid-Coast	Mid-Range Oregon	North Inland (OR/CA)	Mid-Range California	Southern Range	East Disjunct California
Upland	10	4		16	2	2	1
Ultramafic upland	1	5	17	9	19	11	
Riparian [1]				1	7	1	6
Ultramafic riparian			1	1	11	6	3

[1] Riparian zones were not specifically sampled to develop the plant association classification in Oregon, hence the paucity of riparian associations for Oregon.

Table 3&4-12.—*Estimated acreages of stands with Port-Orford-cedar prominent in the overstory by geographic area and plant association group* [1]

	Geographic area							
	Oregon				California			
Plant association group	Northern Coast	Mid-Coast	Mid-Range	North Inland	North Inland	Mid-Range	South-ern Range	East Disjunct
Upland	24,863	6,072	920	3,082	1,150	1,196	69	92
Ultramafic upland	5,561	9,380	10,854	5,695	2,010	2,010	1,005	201
High-risk riparian	13,243	3,526	0	3,403	1,107	1,107	82	164
High-risk ultramafic riparian	2,100	8,600	7,800	8,300	2,700	2,700	1,000	70
High-risk upland [2]	6,085	6,181	4,710	5,266	1,896	1,282	430	117
High-risk total	21,430	18,310	12,510	16,970	5,700	5,089	1,512	351
% of total infected	47	66	64	83	82	73	70	67
Area totals	45,767	27,578	19,574	20,480	6,967	7,013	2,156	527
Grand total								130,062

[1] See text for discussion of how acreages were estimated; grand total estimated area is 130,062 acres [42% of total acres with at least one POC].
[2] Included in upland or ultramafic upland.

association group maps. In the latter, plant association groups are grouped more as a unit of vegetation classification, and less by landforms/geology. Acreages were estimated overlaying the GIS map of POC locations with the ecoregions/subsections (Map 3), and then subtracting the areas where POC is not prominent in the overstory. The proportion of riparian versus upland plant association areas uses estimates developed by Don Goheen (see Relation of Environmental Processes to *Phytophthora lateralis* Infection section that follows), and the acreage of plant associations for ultramafic versus nonultramafic is based on the number of plant associations tallied.

POC comprises on average 27 to 50 percent of the overstory cover in plant associations where it is prominent in the overstory (Table 3&4-13). Usual cohorts on non-ultramafic sites are Douglas-fir and tanoak, although red fir, incense cedar, western hemlock, or other species

Table 3&4-13.—*Average abundance (as indicated by percent cover) of Port-Orford-cedar in plant association groups where Port-Orford-cedar is prominent in the ovestory*

Plant association group	% POC overstory cover	% total overstory cover	POC as % of total overstory cover	% POC understory cover	% total understory cover	POC as % of understory cover
Upland	27	78	27	15	27	56
Ultramafic upland	30	80	38	3	16	19
Riparian	37	87	43	4	14	29
Ultramafic riparian	37	74	50	6	15	40

are also possible. On ultramafic sites, cohorts are usually limited to Jeffrey pine, tanoak, or western white pine. POC trees are very long lived. Jimerson and Daniel (1994) found an average age of 352 years on study plots, with most trees in the 326-to-425-year age-group. Disturbance (other than from PL) is from infrequent fire events, because of the continually wet environment.

Tree understory abundance of POC is generally low in northwestern California (averages 4 percent cover) and greater in southwestern Oregon (averages 31 percent cover). Abundance varies with available moisture, with greater cover in moister environments.

Ultramafic Functions

Ultramafic POC ecosystems make up varying portions of the seven geographic areas, ranging from 17 percent of the major POC plant associations in the Northern Coast geographic area to 95 percent of the Mid-Range Oregon geographic area (the primary ultramafic region). POC on average makes up 38 percent of the overstory on ultramafic upland sites and 50 percent of ultramafic riparian sites (Table 3&4-13).

POC is associated with rare plants of ultramafic systems. Because it is often one of the few, or only, tree species that can tolerate these sites, POC probably has a key role in maintaining their function through shading and stabilizing soils. POC also recycles calcium on these sites, making it more available to other species (Zobel et al. 1985).

POC lost to PL in riparian zones would gradually be replaced by those of other conifer species in some riparian areas, and not in others. Down wood recruitment of POC into streams would increase as areas become infested, because tree mortality would accelerate, but eventually be lost in infested areas because large POC trees would eventually die out.

Riparian Functions

POC has a keystone role in many riparian ecosystems. Where present, it plays a role in maintenance of water quality. In some cases it is the only tree species contributing to woody structure in streams; in others it occurs in a mix of species. It can provide shade and thereby lower stream temperatures. It may also provide bank stability, and when it dies and falls into the stream, aquatic structure. These factors are key elements of habitat for fish, amphibians, aquatic insects, and other organisms. Since POC is highly resistant to decay, it may be expected to have a longer residence time in streams than other associated conifers. This may be especially important on serpentine soils where POC may be the only, or most abundant, tree species growing on a site.

Terrestrial Woody Material

In additional to its role in aquatic ecosystems, woody material also has a terrestrial role: it provides habitat for scores of animal species, notably insects; facilitates mycorrhizal development; and serves as a long-term nutrient source for soil development. Standing woody material (snags) provide habitat for some bird and mammal species. Woody material, both standing and down, also moderates the immediate microclimate by serving as a moisture source in warm, dry environments. This is important for the establishment of some species.

Natural (not infected with PL) snag and down wood levels for all species are presented in Table 3&4-14. Ultramafic sites showed the lowest density of snags. Upland non-ultramafic sites had the greatest density of down wood. California sites (all associations combined) has the least amount of down wood but the greatest amount of snags, perhaps because of their recent death from PL infection.

In California, the down wood was composed primarily of Douglas-fir and POC, with 13 additional species represented at low percentages. Oregon species composition is probably similar, except in the Coast Range, where western hemlock snags are prevalent.

Because of their resistance to decay, dead POC would be expected to remain in an ecosystem for a longer period of time than most other conifers when the frequency and extent of wildfires are controlled. Because the wood is decay-resistant, woody material is expected to persist longer than that of softer species. This makes their value in riparian zones persist over time, but also means they are less valuable than softer species for wildlife snags, because the harder wood means fewer wildlife cavity excavations.

Relation of Environmental Processes to *Phytophthora lateralis* Infection

Although POC occurs in a wide range of environments, the highest risk of infection is associated with wetlands and riparian zones. PL moves through water easily; on dry sites or in droughty conditions its spores lay dormant. The zone of high risk, however, is restricted to a narrow strip along streams affected by water level in the soil profile. Typically this is 10 to 25 feet on either side of the stream (see Pathology section for further discussion.) POC growing in upland situations usually escapes infection even when the pathogen is established in nearby drainages or wetlands.

The Pathology section describes the percent of POC at high risk, and the 100-year infestation prediction, by risk region. The relationship of the ecoregions and geographic areas to the risk regions is shown in Table 3&4-15, by acres. The risk levels can be generally equated to the geographic areas and ecoregions as follows.

Northern Coast: POC is distributed widely across the landscape. High-risk portions of riparian zones comprise 33 percent of the area where POC is prominent. This area was infested beginning about 50 years ago; the pathogen is widespread, and the infestation rate has nearly stabilized. There are pockets of uninfested POC on high-risk sites (Betlejewski

Table 3&4-14.—*Snags and downed woody material by plant association group* [1]

	Woody material		
Plant association group	Snags per acre	Down wood (ton/acre)	Downed wood (pieces/acre >20" diameter)
Ultramafic upland	6	3.5	1
Upland cool, dry	26	42.3	27
Upland moist	23	56.7	18
California (all associations)	31.4	40.2	17

[1] Data are for Oregon unless other noted; data for riparian associations are not available; values are means.
Source: "Port-Orford-CedarRange-wide Assessment", Ecology chapter [Jimerson et al. 2003].

Table 3&4-15.—*Relationship of ecoregions/geographic areas to Port-Orford-cedar risk regions, in acres for plant associations with Port-Orford-cedar prominent in the overstory*

	Risk Regions [1]					
	Oregon			California		
Ecoregion/geographic area	North Coast	Siskiyou	Inland Siskiyou	Siskiyou	Disjunct California	Totals
Northern Coast						
Mid-Coastal Sedimentary	24,553	1,403	477			26,432
Southern Oregon Coastal Mountains	13,794	5,540				19,335
Total	38,347	6,943	477			45,767
North Inland						
Inland Siskiyous	119	6,041	9,317			15,477
Siskiyou Mountains		1,986	224	7,064		9,274
Umpqua Interior Foothills			229			229
Rogue/Illinois Valleys		57	112			170
Red Butte		1,212	808	3		2,023
Other	34	103		137		275
Total	153	9,400	10,690	7,204		27,447
Mid-Coast						
Coastal Siskiyous	909	24,131	2,539			27,578
Total	909	24,131	2,539			27,578
Mid-Range						
Serpentine Siskiyous		14,170	1,253			15,423
Gasquet Mountain Ultramafic		14		4,215		4,229
Western Jurassic		1,110	22	5,803		6,935
Total		15,117	1,275	10,017		26,587
Southern Range						
Eastern Franciscan				1,662		1,662
Pelletrean Ridge				436		436
Rattlesnake Creek				65		65
Total				2,156		2,156
East Disjunct California						
Eastern Klamath Mountains					1	1
Lower Scott Mountains					83	83
Upper Scott Mountains					443	443
Total					527	527
Grand totals	39,409	55,591	14,981	19,377	527	130,062

[1] See the Pathology section.
[2] Percent high risk is from the Pathology section.

and White, *personal communication*), but it seems only a matter of time before most are infected. Most original cedars in infested high-risk sites have been killed (general estimate is 90 percent). The rest of POC on this landscape (67 percent) can be considered upland, and about 6,000 acres of this is high risk.

Mid-Coast, Mid-Range in Oregon and California, Southern Range, and East Disjunct California. PL has not been here as long as in the North/Mid-Coast. Many POC areas, particularly those in the upper part of drainages, have not yet been infested. POC is more closely associated with riparian zones than in the northern part of its range.

North Inland (Siskiyou Mountains). Riparian areas cover about 55 percent of the POC area where POC is prominent in the overstory, but in much of this area about 85 percent of the area is at high risk. The additional risk comes from the relatively dense road network of this ecoregion. Roads facilitate spread of PL by mud adhering to vehicles, horses, and wildlife.

Diversity

Plant species diversity. As with the classification and mapping of ecosystems, diversity can also be organized at multiple scales. When POC plant association data for the entire range are considered, species diversity within POC stands is exemplified by the high number of species found per layer.

In the overstory tree layer alone, 29 species are identified. The shrub layer included 93 species, and the forb layer 446 species. The total of 568 is considered the rangewide species richness (number of species) in the 90 plant associations in which POC is prominent. Members of the tree and shrub layers are considered indicator species (meaning that they are closely and consistently associated with environmental thresholds where moisture, elevation, etc., changed and were associated with different ecosystems). Species found in the shrub and forb layers help define the major and minor environmental gradients (changes in environmental variables over space) and are used in the plant association classifications.

This high species diversity is typified by the wide ecological gradients in which POC and its associated species are found. Data analysis has shown elevation, ultramafic soils, microposition, moisture, temperature, and solar radiation to all have correlations with distribution of POC.

The wide environmental gradient included within the POC communities is indicated by the work of Millar et al. (1991) (see Genetics section) using allozyme research to represent genetic diversity. The wide range of associated species help to define the major environmental gradients used to describe vegetation series and subseries.

Plant series and plant association diversity. POC has a wide ecological amplitude (that is, it occurs over a wide range of environments). The species overlaps with portions of the ranges of Douglas-fir, White Fir, Jeffrey Pine, and Western White Pine Series and in portions of the environmental range of the Tanoak, Western Hemlock, and Shasta Red Fir Series.

Multivariate statistical analyses of data from plots in Oregon and California from the Port-Orford-cedar Series have resulted in a classification with 64 plant associations with POC as a major overstory species (Atzet et al. 1996; Jimerson and Daniel 1994; Jimerson, et al. 2000).

Vascular plant species richness (number of species) is presented by plant association group and geographic area in Table 3&4-16. The table also shows the within-plant association-group richness as a percentage of regional species richness.

POC plant associations occur in environments where POC is better adapted to survival than other tree species. The overall range of POC, however, includes plant associations from other plant series: western hemlock, Douglas-fir, Jeffrey pine, tanoak and white fir. The species itself is more widely distributed than would be suggested by examining only the series distribution.

Port-Orford-Cedar Plant Associations with Unique Species and Regional Endemic, Rare, or Sensitive Plants

POC plant associations contain unique species and regional endemic, rare, or sensitive plants. At least 30 plant species considered sensitive in FS Regions 5 and 6, of special status to the BLM, or rare by the California Native Plant Society (Skinner and Pavlik 1994) and the Oregon Natural Heritage Program (2001), are found in plant associations that contain POC. (In addition to the discussion below, sensitive, listed, and other rare species are discussed in the Botany section in this chapter, or in the draft biological evaluations in Appendix 7.) Eleven of these rare or unique plant species are found only within POC plant associations, predominantly on wetland/seep or riparian areas. Plant associations with the highest diversity of rare plants are those that capture microhabitat extremes, from continually wet soils to dry soils in exposed sites. The plant association with the highest number of rare plants is Port-Orford-cedar-California Bay/ Evergreen Huckleberry.

A majority of rare or sensitive plants in POC associations occupy habitats with surface (perennial or intermittent) or sub-surface water in the form of spring or seep flow. The

Table 3&4-16.—*Species richness of plant associations containing Port-Orford-cedar by geographic area and plant association group (in average number of plants)*

	Geographic Areas [1]						
Plant association group	Northern Coast	Mid-Coast	Mid-Range Oregon	North Inland	Mid-Range California	Southern Range	East Disjunct California
Upland	26.7 [101]	23 [210]	21 [88]	32.0 [480]	22.5 [67]	No data	24.7 [14]
Ultramafic upland	No data	29.0 [93]	22.6 [308]	24.6 [382]	23.4 [248]	23.9 [284]	No data
Riparian	No data	No data	No data	No data	30.7 [17]	24.2 [31]	25.5 [15]
Ultramafic riparian	No data	No data	No data	23.0 [30]	15.3 [169]	20.0 [51]	21.6 [24]

[1] The first four geographic areas listed are in, or partly in, Oregon; the remaining are in California. Riparian zones were not specifically sampled to develop the plant association classification in Oregon; hence, the lack of data for these groups.

unique California pitcher plant (*Darlingtonia californica*) is the most commonly noted hydrophytic species, followed by California lady's slipper (*Cypripedium californicum*). These species are endemic to serpentine wetlands (fens, riparian areas, seeps) and are represented in various associations across the range of POC.

In comparison to the California pitcher plant and California lady's slipper, there are other wetland species associated with POC that are more localized in their distribution. For example, the narrow endemic Western bog violet (*Viola primulifolia* var. *occidentalis*) occurs in fens and other serpentine wetland habitats in the Gasquet Mountain Ultramafic Subsection in California and Oregon. The large-flowered rush lily (*Hastingsia bracteosa*) is a narrow endemic found in the Eight Dollar Mountain area of the Siskiyou Mountain Ecoregion of Oregon. It occurs in riparian and wetland settings along with Oregon willow herb (*Epilobium oreganum*) (Kagan 1990a, 1996). Waldo gentian (*Gentiana setigera*) is found in the gently-sloping serpentine wetlands across the Gasquet Mountain Ultramafic Subsection, Coastal Siskiyou Ecoregion of Oregon, and the Siskiyou Mountain Ecoregion of Oregon. Waldo gentian is also found in two, high elevation associations: Port-Orford-cedar-Shasta-Red Fir-Brewer's Spruce/Sadler Oak-Huckleberry Oak and Port-Orford-cedar-Shasta Red Fir/Sitka Alder-Sadler Oak. This occurrence of Waldo gentian in montane habitats has been noted by Kagan (1990b) in his management guide for this species. POC plant associations in the Lower and Upper Scott Mountain subsections of eastern California support rare plants distinctive to this area including Scott Mountain phacelia (*Phacelia dalesiana*), showy raillardella (*Raillardella pringlei*), and crested potentilla (*Potentilla cristae*).

Effects of the Alternatives

Because infection with PL eventually leads to death of POC, the reduction of this species will have effects on ecosystems. Overstory trees will be killed in infested areas. Jimerson and Daniel (1994) found the average age of most overstory trees to be 326 to 425 years, so replacement of "in kind" dead overstory will take a long time. Understory POC trees are likely to persist over time, but it is unlikely they will grow into the overstory in infested areas unless they are resistant to PL.

Table 3&4-17 illustrates the anticipated infestation, in acres, of POC from ecosystems in each of the six geographic areas. Estimates are further segregated by plant association group, to illustrate the effects on ultramafic and riparian areas. The acres shown are only for those plant associations where POC is prominent in the overstory. Additional infestation acres (see Pathology section) are not included here.

In this section, the projected acreage losses by alternative are presented, followed by their effects on key ecosystem functions.

Note: Regarding riparian zones—PL has a higher rate of infestation in riparian zones than in other areas. The zone of high risk, however, is restricted to a narrow strip along streams affected by water level in the soil profile. Typically this is 10 to 25 feet on either side of the stream. For all purposes in this effects section, this is the riparian zone referred to, not broader zones as in Northwest Forest Plan documentation. Areas in Table 3&4-17 are also based on this definition. See the Pathology section for further discussion.

Table 3&4-17.—*Predicted infestation acres in 100 years by subdivisions of plant association groups* [1]

	Geographic area								
	Oregon				California				
Plant association group	Northern Coast	Mid-Coast	Mid-Range	North Inland	North Inland	Mid-range	Southern Range	Disjunct California	Totals
Existing condtions									
Upland	18,778	6,072	920	3,082	1,150	1,197	69	92	37,444
Ultramafic upland	5,561	9,380	10,854	5,695	2,010	2,010	1,005	201	36,716
Riparian	13,243	3,526	0	3,403	1,107	1,107	82	164	22,632
Ultramafic riparian	2,100	8,600	7,800	8,300	2,700	2,700	1,000	70	33,270
High-risk upland [2]	6,085	6,181	4,710	5,266	1,896	1,282	445	117	25,982
Total high risk	21,428	18,307	12,510	16,969	5,703	5,089	1,527	351	81,884
High risk as % of total	47	66	64	83	82	73	70	67	63
Area totals	45,767	27,578	19,574	20,480	6,967	7,013	2,156	527	130,062
Alternative 1									
Upland	0	0	0	0	0	0	0	0	0
Ultramafic upland	0	0	0	0	0	0	0	0	0
Riparian	12,233	2,085	0	1,873	829	235	35	76	17,366
Ultramafic riparian	1,963	5,125	4,580	4,558	2,007	2,895	470	32	21,630
High-risk upland	1,208	1,477	1,087	1,709	350	235	200	53	6,319
Total infested	15,404	8,687	5,667	8,140	3,186	3,365	705	161	45,315
Percent of total infested	34	31	29	40	46	48	33	30	35
Alternative 2									
Upland	0	0	0	0	0	0	0	0	0
Ultramafic upland	0	0	0	0	0	0	0	0	0
Riparian	11,744	1,954	0	1,729	783	222	34	78	16,544
Ultramafic riparian	1,885	4,803	4,397	4,211	1,896	2,736	451	33	20,412
High-risk upland	1,160	1,384	1,044	1,579	331	222	192	55	5,967
Total infested	14,789	8,141	5,441	7,519	3,010	3,180	677	166	42,923
Percent of total infested	32	30	28	37	43	45	31	31	33

	Geographic Area								
	Oregon				California				
Plant association Group	Northern Coast	Mid-Coast	Mid-Range	North Inland	North Inland	Mid-range	South-ern Range	Disjunct California	Totals
Alternative 3									
Upland	0	0	0	0	0	0	0	0	0
Ultramafic upland	0	0	0	0	0	0	0	0	0
Riparian	10,362	1,592	0	1,378	647	185	31	71	14,266
Ultramafic riparian	1,663	3,913	3,461	3,355	1,569	2,274	407	30	16,672
High-risk upland	1,023	1,128	822	1,258	274	185	173	50	4,913
Total infested	13,048	6,633	4,283	5,991	2,490	2,644	611	151	35,851
Percent of total infested	28	24	22	29	36	38	28	29	28
Alternatives 4 & 5									
Upland	0	0	0	0	0	0	0	0	0
Ultramafic upland	0	0	0	0	0	0	0	0	0
Riparian	15,177	3,181	0	2,934	1,209	336	42	97	22,976
Ultramafic riparian	2,436	7,820	7,107	7,145	2,930	4,133	557	41	32,169
High-risk upland	1,499	2,253	1,688	2,680	512	336	237	69	9,274
Total infested	19,112	13,254	8,795	12,759	4,651	4,805	836	207	64,419
Percent of total infested	42	48	45	62	67	69	39	39	50

[1] Does not include acres restored with resistant stock.
[2] Included in upland or ultramafic upland.

Riparian zone acres in Table 3&4-17 are proportional to the estimate of the relative abundance of riparian plant associations in the geographic areas, based on sample sizes of the plant associations in Atzet et al. (1996) and Jimerson and Daniel (1994).

Effects Common to All the Alternatives

Because implementation of this SEIS would not directly affect areas in California, for these areas all alternatives are expected to show the same effects as for Alternative 1 (the current course of action). As discussed in the Cumulative Effects section earlier in this chapter, slight increases or decreases from these numbers could be expected if the Oregon units select an alternative substantially different than the current direction in California. Those differences are too small to be reflected in this analysis.

Alternative 1

This alternative is the current course of action under existing standards and guidelines. Based on the assumption that 15 percent of the Coos Bay/Powers administrative areas are currently infested, and 9 percent of all other areas are infested, it is estimated 25,700 acres of stands where POC is prominent are infested within the range of POC. the range of POC are infested. Under Alternative 1, the estimated area infested in 100 years would be 45,300 acres, or 35 percent of the acres where POC is prominent. The estimated acreage for each geographic area under Alternative 1 (as well as the other alternatives) is displayed in Table 3&4-17. Acreage estimates are based on the assumption of moderate to heavy (depending on geographic area) percent of area affected in riparian zones, versus little or no infestation on upland areas (see Pathology section). Infestation estimates are primarily based on the density of streams and roads, and in California, by the closer relationship of POC to riparian zones. The North Coast and Mid-Coast areas have relatively high rainfall and stream densities compared to the other areas. The Mid-Coast, Mid-Range, and North Inland (in Oregon) areas were assumed to have high road densities, and hence, more areas affected by PL.

Alternative 2

This alternative adds a risk key to add more consistency to the application of prescribed mitigation measures. The projection of the infested acres 100 years from now is 42,900 acres, or 33 percent of the acres where POC is prominent, not substantially different from the 35 percent estimated infestation for Alternative 1. This is true for all the geographic areas as well.

Alternative 3

This alternative includes the standards and guidelines from Alternative 2 and adds additional direction for activities in 32 currently uninfested 6th field watersheds, primarily in the North Inland geographic area. The projection of the infested acres 100 years from now is 35,850 acres, or 28 percent of the acres where POC is prominent. This alternative is the most effective at maintaining the diversity and abundance of plant associations of the alternatives considered. Alternative 3 will provide the highest probability of retaining intact POC ecosystems with all ages of trees represented.

In Oregon, this alternative would have little additional effect on the Northern Coast geographic area (when compared with Alternative 2) because there are no uninfested 6th field watersheds in this area. Throughout the other Oregon geographic areas, reductions in infested areas averaging 6 to 8 percent would be effected (when compared with Alternative 2) if this alternative is adopted.

Alternatives 4 and 5

Alternatives 4 and 5 remove active POC management measures, and variously rely on the use of genetically-resistant POC stock for restoration planting. These alternatives are projected to lead to the greatest infestation of POC—64,400 acres at 100 years, or 50 percent of the acres where POC is prominent. As with other alternatives, the least effect would be on the Northern Coast, projected to receive a 2 percent decrease in POC, relative to Alternative 1. Effects on the Mid-Coast, Mid-Range, and North Inland in relation to Alternative 1 would be larger: 12 percent, 12 percent, and 17 percent, respectively, above the amount projected with Alternative 1.

In general, Alternative 3 would lead to the least reduction of POC from ecosystems, Alternatives 4 and 5 the most, and Alternatives 1 and 2 would be in between. This pattern follows for all the effects on ecosystem functions that follow. These effects do not consider replanting with resistant stock.

Effects on Ultramafic Ecosystems

Ultramafic POC ecosystems make up varying portions of the seven geographic areas, ranging from 17 percent of the North Coast to 95 percent of the plant associations where POC is prominent in the Mid-Range Oregon geographic area (the primary ultramafic region). POC on average makes up 38 percent of the overstory on ultramafic upland sites and 50 percent of ultramafic riparian sites (see Table 3&4-13). Alternative 3 would lead to the most conservation of these areas, Alternatives 4 and 5 the least, and Alternatives 1 and 2 somewhere in between.

Where there is a reduction of POC, particularly in riparian zones, there would be a change in ecosystems. On ultramafic sites, POC is much less likely to be replaced by other tree species (White, *personal communication*; Ollivier, *personal communication*). Instead the shrub layer would be expected to increase. The POC roles of providing shade for understory plants and providing downed wood for a long-term source stream structure would be reduced. Because the species is very long-lived, replacing old trees with seedlings could require hundreds of years to achieve the same level of forest structure where POC is lost from the ecosystem.

Riparian Effects

Loss of POC would affect downed wood structure in streams. As stated in the previous section, other species are not likely to replace all POC, particularly on ultramafic sites and those that might be less valuable as riparian downed wood. Study sites along the Smith River in California showed increased amounts of red alder following the death of POC. This would provide abundant shade in the short term. Alder downed wood, however, decays relatively rapidly and is typically of small diameter. Alder logs typically persist 1 to 2 years, while those of conifers last for decades. (Ollivier, *personal communication*). In areas where alder did not invade rapidly, stream shade would be reduced, possibly leading to increased stream temperatures in streams not snow-fed. This in turn might have deleterious effects on fish, including anadromous salmonids where present. The potential for such effects is discussed in detail in the Water and Fisheries section.

Large conifer downed wood in the Smith River was found to provide much of the habitat complexity for amphibians and other organisms (Ollivier, *personal communication*). Presumably this is also true throughout the range of POC.

When POC is logged to reduce spread of PL, other merchantable trees are also often removed. This can set back recruitment of large conifer downed wood for decades (Ollivier, *personal communication*). Current aquatic conservation strategy guidelines, however, would prohibit logging in most riparian zones with POC.

Loss of POC in the aquatic ecosystem would be most deleterious in the Mid-Coast, Mid-Range Oregon, and North Inland Oregon geographic areas where the highest proportion of riparian areas feature POC. These areas also have a high proportion of ultramafic areas, where POC is particularly important because other tree species are often less available. It would be least deleterious in the Northern Coast, where western redcedar may be able to fulfill some of the downed wood role. Western redcedar is not abundant in the other geographic areas.

Snags and Downed Wood

Snags and downed wood have largely been detailed in the previous Riparian Effects section. The value of POC snags for terrestrial wildlife is probably less than other conifer species, because of the hard nature of the wood. Its primary value is in providing downed wood for aquatic systems.

Plant Diversity

Effects on plant diversity are detailed in the Botany section. One note, however, is the presence of the Port-Orford-cedar/Shasta-red-fir/Brewer's spruce/Sadler oak-Huckleberry oak association in the North Inland geographic area. Tests have shown the POC in this association to have the highest percentage of resistant trees (Betlejewski, *personal communication*). Conservation of this association, which is known to occur on only a few high elevation sites, would have value as a potential source of material for producing disease-resistant seedlings.

Structural and Landscape Diversity

Species loss is driven by habitat loss. Reduction of POC in high-risk areas across the landscape will reduce diversity at both local and broad scales, leading to a more homogeneous landscape. Such a landscape is less resilient (if POC is greatly reduced on the landscape, species or ecosystems may be less resilient to change) (Lindenmayer and Franklin 2002). For example, if western redcedar were to replace POC on some sites, and redcedar itself one day becomes vulnerable to a pathogen (such as Sudden Oak Death), the ecosystem will be more affected than if POC were still present.

Botany

Affected Environment

POC is found from southwestern Oregon to northern California, primarily in the Coast Range, Siskiyou and Klamath Mountains. There is a small disjunct population in the Scott Mountains of California (see Figure 1-1). The following discussion is organized by the same geographic grouping of plant associations as the Ecology section, to capture the range of threatened and endangered species, plant diversity, and ecosystem functions. POC has a narrow geographic range, and occupies variable and different habitats.

Northern Coast comprises the mid-Coastal Sedimentary and Southern Oregon Coastal Mountains Ecoregions. This area has lower elevation, higher rainfall, and dense coniferous forests. *Lilium occidentale* (western lily) is found in openings within stands of POC (Brian [Date.]; Segotta [Date.]). *Note:* See accompanying biological evaluation for identification of which species in this discussion are state or federally listed as threatened or endangered.

North Inland includes the Inland Siskiyou and Siskiyou Mountains Ecoregions. Conditions here are highly varied, and the area has high species diversity. Many rare plants are endemic or have their greatest extension here, such as *Castilleja miniata* ssp. *elata*, *Epilobium oreganum, Darlingtonia californica, Cypripedium californicum, Gentiana setigera, Hastingsia bracteosa* var. *atropurpurea, Hastingsia bracteosa* var. *bracteosa, (*Lang and Zitka 1997), *Viola primulifolia* var. *occidentalis,* and *Smilax jamesii* occur from Smith River to Eight Dollar Mountain with the highest number of rare species along Josephine Creek and Eight Dollar Mountain. *Note:* Rare in this context includes unique, locally endemic, narrow ecological amplitude, Agency sensitive, and state or federally listed as threatened or endangered. These sensitive species share *Darlingtonia* fens or streams in ultramafic soils with POC.

Mid-Coast comprises the Coastal Siskiyou located in Oregon; it is an area with rugged mountains and high gradient streams, and a few alpine glacial lakes. This area has higher precipitation rates, with *Darlingtonia californica, Cypripedium californicum,* and *Gentiana setigera* associated with serpentine wetlands from Gasquet Mountain Ultramafics, Serpentine Siskiyous to Coastal Siskiyous.

Mid-Range includes the Serpentine Siskiyou/Gasquet Mountain Ultramafics of California Ecoregions and the Western Jurassic subsection. POC is found at higher elevation in this highly diverse ecoregion. POC here is also found in drier peridotite soils, which is also the preferred habitat of *Arabis macdonaldiana* (Vorobik), endangered rock cress. *Arabis macdonaldiana* grows in the barest unoccupied peridotite rock, at the most sharing these microsites with Idaho fescue and sedums. Jeffrey pine does well in this habitat type, and could increase its presence in the absence of POC (Brian). These ecoregions have extensive fens, from very small seeps to hanging fens that run for more than a mile on the side of the mountain, especially on Oregon Mountain and Rough and Ready Creek.

The Western Jurassic subsection is moderated by marine air creating a temperate to humid environment, making this subsection the second highest in POC abundance. *Arabis macdonaldiana* occurs on peridotite in openings within POC stands.

East Disjunct California includes the Eastern Klamath Mountains and Lower Scott Mountains subsections where sensitive species like *Balzamorhiza sericea*, *Chaenactis suffrutescens, Epilobium oreganum, Erythronium citrinum* var. *rodereckii, Ivesia pickeringii, Penstemon filiformis, Phacelia leonis,* and *Smilax jamesii* occur*;* and the Upper Scott Mountains subsection which is home to *Arctostaphylos klamathensis, Epilobium siskiyouensis*, *Minuartia stolonifera, Phacelia dalesiana*, *Phacelia greenei, Potentilla cristae, Raillardella pringlei,* and *Smilax jamesii* (Nelson). The three areas share the same geologic pattern.

Southern Range includes the Eastern Franciscan, the Pelletreau Ridge, and Rattlesnake Creek subsections. The first represents the higher elevation coastal, the second stands alone, and the third is on peridotite with a small population of POC. The Rattlesnake Creek Terrane is home to *Epilobium oreganum* which here occupies stream areas, meadows, and seeps without *Darlingtonia californica* as an associate species.

There are no federally or state-listed threatened or endangered plants that occur in the riparian zone. The BLM and FS sensitive and other rare plants that occupy and share habitats with POC in general are in good overall condition. Some of them are affected by other activities such as grazing, mining, recreation (especially off-highway vehicles), wildfire, noxious weeds, timber harvesting, roads, and fire suppression (Frost).

Because fire suppression, previously more open fens and some of the riparian areas have been encroached by shrubs and trees that compete with rare vascular plants for space and moisture. This is most evident on the Oregon Mountain and Rough and Ready Creek fens. The upper reaches of Josephine Creek were burned in 1994 by the Mendenhall Fire and back-fired during the 2002 Biscuit Fire. POC's highest benefit to rare vascular plants appears to be providing soil stability and shade. The Days Gulch fen, for example, was affected by the Biscuit Fire and had been burned under prescription twice previously. Erosion was evident because the grass, pitcher plant, and shrubs have been burned without enough time in between the last prescribed fire, Mendenhall, and the Biscuit back-firing to allow for regrowth. Sediment was deposited within the fen, burying a small population of *Epilobium oreganum* where a road culvert slowed runoff.

POC is a prolific seed producer with an estimated 40 million seedlings within the range in both states (Goheen, *personal communication*). However, large old POC trees have a higher value than seedlings to the environment in general, and rare plants in particular. In some areas, POC is a barrier between the recreating public and rare plants, especially off-highway vehicle users. The growth form of POC creates a fence-like barrier with boughs that prevents the public from seeing vulnerable ecosystems like fens or seeps in some areas.

POC forms endomycorrhizae with some fungi (Zobel 1985); most herbaceous plants are endomycorrhizal, but the relationship between POC and vascular plants has not been studied (thus a connection has not been established).

Arabis macdonaldiana occupies peridotite openings in the Gasquet Mountains/Serpentine Siskiyou Ecoregion, sharing similar soil conditions but separate habitats than POC. A dependent relationship has not yet been studied or established.

Effects of the Alternatives

Potential effects to species listed under the "Endangered Species Act" are also discussed in the draft biological evaluation in Appendix 7.

Alternative 1

This alternative is the current management direction for BLM districts and the Siskiyou NF. It seeks to reduce or prevent introduction of the pathogen into disease-free areas by closing roads into these areas during the rainy season to prevent carrying the spores from infested to uninfested areas, analyzing the risk of introduction to disease free areas, developing mitigation measures at the project level, informing the public about the reason for these measures (see Appendix 2), and other provisions.

The effects of Alternative 1 to the botanical environment are varied. The areas with the highest presence of rare plants appear to be free of infestation, with the exception of Whiskey Creek, narrow bands on lower Josephine Creek, and Middle Illinois River. Seasonal road closures prevent the introduction of noxious weeds to rare plant areas when soil conditions are optimal for seed germination. Another positive effect from this alternative to rare plant habitats is vehicle and equipment washing. Washing substantially reduces he probability of introducing noxious weeds. Gates help prevent off-highway vehicle recreation, which has a positive effect on rare plants by decreasing soil disturbance at a time when soil moisture is high and vulnerable to erosion and compaction.

Alternative 2

This alternative is similar to Alternative 1, except that practices currently implemented or recently developed are better described, and a risk key is included for clarification of the environmental conditions that would trigger additional control or mitigation measures. Implementation of disease-mitigating practices is expected to be more consistent because of the key.

The effects of Alternative 2 are similar to Alternative 1. Implementation would reduce the rate of spread of the disease when compared to Alternative 1. Continued development of resistant stock would make stock available for timely replacement in important habitats. Alternative 2 would help maintain a lasting presence of POC in unique plant communities, which seem to be more abundant in high-risk areas.

Alternative 3

Alternative 3 adds additional protection measures to 32 uninfested 6th field watersheds that have at least 100 acres occupied by POC. It divides these watersheds into POC cores and buffers and applies additional standards and guidelines to each to lessen introduction of infection to the POC core areas.

The effects of Alternative 3 are the same as Alternative 2, with the exception of effects within the 32 uninfested watersheds. In these watersheds, the prohibition of harvest and discretionary uses in POC cores would increase the probability of a lasting presence of POC in unique plant communities in these areas. Unique plant communities seem to be more abundant in high-risk areas. Closing roads and lessening off-highway vehicles and other disturbances to rare plant communities would provide other benefits to rare plants through decreased disturbance and decreased weed introductions throughout the watersheds.

Alternatives 4 and 5

Alternative 4 would remove all preventive measures that are currently in place and would speed up the resistance-breeding program to more quickly replace POC killed by the disease with resistant seedlings. Alternative 5 would remove all preventive measures and discontinue development of the resistant-breeding program. Existing resistant seed orchard trees would continue to be used to reforest areas of mortality in breeding zones for which resistant stock is already developed.

The effects of Alternatives 4 and 5 are similar, differing only in the mid and long term where Alternative 4 would deter advancement of the disease by increasing the introduction of resistant stock. Alternative 5 would allow POC to depend on natural resistance to the pathogen, which it has, but at low rates.

These alternatives would allow for faster advancement of the disease compared to the current direction in high-risk areas (see Pathology section). The effect of this high mortality on rare plants is unpredictable. POC is a large component of riparian habitats in areas where it is the largest tree species. It would be logical to infer that the loss of shade and stream bank stability that would result from the loss of POC would have a negative effect on the sensitive and rare plants that are adapted to stream microsites.

In all, there are negative effects to plant communities if POC is killed by PL, yet negative effects of the loss of POC to threatened and endangered plants cannot be determined from the known information.

Water and Fisheries

Affected Environment

The POC range includes southern Oregon coastal watersheds, northern California coastal watersheds, and upper portions of the Willamette Basin, Rogue Basin, and Klamath Basin.

High-Risk Sites

High-risk sites for transmission of PL infestation include water flowing in linear channel features and direct water influence zones including connected off-channel areas and floodplains. Included are road ditches that link with the stream network and gullies formed from cross-drain runoff that continues downslope until a drainageway is met. Standing water such as lakes, fens, bogs, and topographic depressions with soils exhibiting persistent high water tables may have lower transmission rates, but are in the category as high-risk. The high-risk zone is directly associated with water and is almost always much narrower than the Northwest Forest Plan Riparian Reserves.

POC is not normally infected more than 40 feet downslope from roads or trails, except where streams, culverts, wet areas or other roads are present to facilitate further movement (Goheen et al. 1986). As was stated in the previous section on Pathology, the probability of infection downstream is highest when PL inoculum is introduced directly into water at a stream crossing or a ditch and POC with their roots in the water are present downstream within 50 feet. Although a recent dendrochronological study provides evidence of infection beyond 160 feet (Jules and Kauffman 1999), limitations to the study make it impossible to ascertain if the transmission was actually over this distance or resulted from several small tree infections between the initial source of inoculum and the large tree that was studied. In any case, the probability of infection at distances greater than 50 feet is very low (2 to 4 percent).

Streams and Flow Paths

Stream densities vary by physiographic provinces. The Coast Range Province has total stream densities varying from 5.31 to 12.80 miles per mile square, Franciscan Formation has 6.27 to 9.04 miles per mile square, and Klamath has from 4.63 to 9.76 miles per mile square (FEMAT 1993). At a planning level, ephemeral and intermittent streams are in headwaters positions and can be classified as 1st and 2nd order (Strahler 1964). Perennial streams are normally 3rd order or greater where enough drainage area, soils, relief, and other landscape features interact to form a drainage that can support a year round flow. Ephemeral/intermittent streams vary from 65 to 80 percent of the stream network, and perennial 20 to 35 percent (FEMAT 1993).

Stream uppermost surface origin or pourpoints expand further up the drainage with the onset of maritime winter storms. As soils become saturated, further precipitation would runoff into ephemeral/intermittent stream channels, which are above the water table. Overland flow may also appear on compacted areas, including road surfaces, landings, quarries, or soils with high surface rock contents. Although infrequent, rapid melt of shallow snowpacks in the intermittent snow accumulation zone (above 2,000 to 2,500 feet) can lead to overland or concentrated flow in certain areas, increasing stream flow paths. Road-stream connections from roadside ditches, and gullies from ditch relief culverts entering a channel, can boost the drainage density substantially. In one study in the Cascades (Wemple et. al 1996) stream density increased from 21 to 57 percent, depending on dynamic expansion with increasing levels of stormflow.

Assessment of Salmonid Stocks

The assessment by Oregon Department of Fish and Wildlife and California Department of Fish and Game of the status of steelhead in southwest Oregon in 1997 found that the Winchuck River had healthy stocks, but others had depressed winter and/or summer runs (Illinois, Pistol, Chetco, and Rogue Rivers). Oregon Department of Fish and Wildlife determined that trends in the Rogue were positive and that the steelhead population was stable and not threatened. Winter steelhead spawners roam, and will migrate to other areas if conditions to spawn are not good in one stream. As a result, production can vary dramatically from stream to stream annually (RVCOG 1997). The National Marine Fisheries Service (NMFS) had ruled by 2001 that Klamath Mountain Province steelhead were not warranted for listing as threatened ([online]URL:http://www.nwr.noaa.gov/).

Steelhead habitat is contiguous with that of coho salmon, and 90 percent of the limiting factors for coho salmon are also limiting for steelhead. Similar habitat problems exist for the two species in the Rogue and South Coast Basins. One important distinction is that coho salmon require deeper pools and more side channel habitat than steelhead for optimal rearing (RVCOG 1997).

The NOAA-Fisheries listed wild southern Oregon/northern California coho salmon as a threatened species in May 1997, and Oregon Coast coho salmon were listed as threatened in August 1998. Southern Oregon Coast/ California Coast chinook salmon were ruled not warranted for listing as threatened by September 1999 ([online]URL:http://www.nwr.noaa.gov/).

Current BLM Manual 6840 provides policy and guidance for the conservation of special status species of plants and animals. Oregon/Washington BLM uses three categories for special status species: Bureau sensitive (BS); Bureau sssessment (BA); and, Bureau tracking (BT). Classification is dependent upon the different state of Oregon or Oregon Natural Heritage Program designations.

Fall chinook salmon (BS) and spring chinook salmon (BA) in the Southern Oregon and Northern California Coastal ESU are on the Oregon/Washington BLM special status species list. Bureau 6840 policy requires that any Bureau action not contribute to the need to list (under the Federal "Endangered Species Act") any species with BS designation (IB-OR-2000-092). The BLM Manual at 6840.01 directs the conservation of special status species by the use of all methods and procedures which are necessary to improve the condition of special status species and their habitats to a point where their special status recognition is no longer warranted.

Salmonid Limiting Factors

Salmonids are frequently used as indicators of watershed health and the impacts of human activities because they have complex life histories and specific environmental requirements. All salmonid species in the project area have similar freshwater requirements. For optimum production, all species require cool flowing waters; free passage through migratory routes; clean gravel substrate for reproduction; water with low turbidity during the growing season for sight feeding; high levels of dissolved oxygen content in streams and within gravel; sufficient instream hiding-cover; and invertebrate organisms for food (USDA-FS 1985).

Steelhead, in particular, serve as an indicator species for the fish and aquatic habitats affected by the proposed action because their freshwater requirements are similar to other salmonids, and their habitat extends further upstream than most. In the Rogue and South Coast basins, which correspond to the Oregon portion of the region and south to the Klamath River in California, there are approximately 6,913 total stream miles of steelhead spawning and rearing habitat. About 1,489 miles are designated as high value winter steelhead spawning areas, involving 61 streams. The proportion of Federal ownership on these 1,489 miles of high value streams is 50 percent, and 27 percent Federal ownership of a total of 245 miles of summer steelhead streams (RVCOG 1997).

The Southwest Oregon Salmon Restoration Initiative (RVCOG 1997) identified the representative priority limiting factors for steelhead streams in the Rogue and South Coast Basins, corresponding to most of the Oregon portions of the Region and south to the Klamath River in California. Low stream flows limit summer rearing habitat, increase water temperatures, and increase competition and the risk of predation. High water temperatures foster disease and diminish food supply. Inadequate riparian habitat was identified because stream canopy over side channels and alcoves provides shade which helps reduce stream temperatures, stabilizes streambanks, serves as holding areas for fry and smolts, and provides a food source for aquatic life. Inadequate levels of instream large woody debris were identified because large woody debris provides shelter for steelhead, creates pools, collects spawning gravel, helps reduce water velocity, and provides hiding habitat. Sediment and erosion were limiting factors, as they affect spawning areas, fishery health, and water quality. Fish passage at road crossings was identified as needing improvement

Aquatic Interactions

Habitat characteristics such as channel form, pool riffle sequence, water temperature, water chemistry, water flow depth, velocity, substrate, and cover are linked to the stream adjacent to riparian areas including large woody debris availability, shading, bank stability, litterfall, and nutrient cycling. Five classes of factors affect aquatic biota; food (energy source), water quality, habitat structure, flow regime, and biotic interactions (Spence et al. 1996).

Soils Limiting Forest Growth

POC in the Inland Siskiyou Region is often associated with dark-colored igneous ultramafic rocks. Ultramafic rocks and soils have higher iron and magnesium nutrient availability that limits tree growth of many species. However, POC thrives in these soils and often is the only species supported. The Gasquet Mountain Ultramafics Ecoregion roughly corresponds to this soils area (USDA-FS and USDI-BLM 2003b). There are approximately 33,000 acres of riparian plant associations with a prominence of POC on these soils (Table 3&4-12).

Ultramafic rocks were derived from sections of the seafloor which were produced at spreading centers and then lifted up onto the continental shelf, instead of being subducted. Less than 1 percent of the United States is underlain by ultramafic material ([online] URL: http://jersey.uoregon.edu/~mstrick/AskGeoMan/geoQuerry23.html). These rocks have a relatively low concentration of silica and oxygen, and are enriched in iron and magnesium. They are not stable at surface temperatures and metamorphose into other forms including serpentine ([online] 6URL:http://jersey.uoregon.edu/~mstrick/GeoTours/Josephine%20Ophiolite/JoOphiolite.html). Soils produced from ultramafic rocks can support rare plants.

Headwater Confined Stream Channels

Channel morphology. Headwater confined stream channels in the POC range would be classified as A, or Aa+ (more than 10 percent gradient on bedrock), channels (Rosgen 1996). Characteristics include: steep gradients (generally greater than 4 percent), vertically contained, width/depth ratios less than 12, relatively straight, and do not spread on floodplains with incremental increases in winter flow. These channels are generally 1st and 2nd order, and usually have steep stream-adjacent hillslopes. Substrates vary from bedrock, boulder, and gravels to fine sediments. These channels are above the water table and based on duration of flow are either ephemeral (stormflow only when soils are saturated) or intermittent (longer duration, but less than all year). Headwater channels collect from small catchments (normally less than 1 mile per mile square) that feed into drainages.

PL inoculum present in the water column may affect POC on streambanks, but not in upslope positions (Goheen D.J., *personal communication*).

Bank stability. Bank erosion is caused by stream power from flow and sediment in the channel that can erode channel margins. Bare banks are more susceptible to erosion (soil grain size and ease of detachability become important). Riparian vegetation acts as hydraulic resistance and binds soil particles. Herbaceous vegetation and trees with a matrix of fine and coarse roots that tend to interlock soils counter erosive forces. In headwater channels, banks can be undercut and cause trees to slide into the channel, but this is less frequent because many channels are laterally confined by bedrock. Some sections of channel are prone to downslope soil creep and delivery of whole trees, debris, and soils. Although tree mortality causes fine roots to decay in a few years, the larger roots last considerably longer (Burroughs and Thomas 1977).

Large woody debris. Large wood accumulates in confined channels and becomes reservoirs for sediment accumulation. Large woody debris creates a step-pool system and dissipates stream energies. Many low order streams accumulate large woody debris and sediment for long periods of time that is removed downstream by episodic transport as debris flows (May and Gresswell, *in press*).

Stream temperature. These channels do not contribute to stream heating, because they are dry during the summer months.

Mid-Drainage to Valley Moderately Confined to Unconfined Stream Channels

Channel morphology. Moderately confined to unconfined stream channels in the POC range would be classified as B, C, and D streams (Rosgen 1996). Stream characteristics include: gradients less than 4 percent and generally less than 2 percent, width/depth ratios greater than 12, and meandering on a variety of substrates moved and deposited by the river (alluvium). Higher winter flows cause spreading within the floodplain, at least on one side of the stream. The streams have active channel widths of 15 to 30 feet for B streamtypes and greater than 30 feet for C and D streamtypes. Floodprone areas can be narrow to hundreds of feet wide. The F channel type, common in the northern part of the POC range, is a larger stream on a flat gradient that does not have a floodplain. These streams to rivers are 3rd order and greater and are mostly perennial. Watershed drainage areas would generally be less than 15 miles per miles sqaure for the mid-drainage B channel types and greater than 15 miles per mile square for the C and D channel type valley streams corresponding to the 7th, 6th, and 5th field hydrologic unit boundaries ([online] URL:http://wwwga.usgs.gov/gis/iag.html).

Aspects of fish habitat that are influenced by channel morphology in these streams include pool frequency, residual pool depth, pool complexity, and the presence of side channels and alcoves.

Stream hydrology. Analysis of stream channel gauging data for southern Oregon shows an approximate 1.5 year bankfull flow would just fill the active channel and not spread laterally, while a 100 year recurrence interval flood would have a depth of 2.0 to 2.2 times the mean depth at bankfull (Fogg J., *personnel communication*). The actual flooding width during large storms would depend on the runoff and channel geometry, slope, and roughness.

Inoculum present in the water column may affect POC on streambanks, and laterally away from the active channel to the depth of runoff for a particular event. Major floods in southweswtern Oregon and northern California with extensive flooding occurred in 1955, 1964, 1971, and 1996.

Bank stability. Banks in low gradient mid-drainage to valley streams can be strengthened by dense root systems from shrubs and trees. However, the streambank can still be easily undercut, particularly on outside of channel bends and may reverse the binding effect of roots. Normally, tree roots are wide and spreading and are not more than a few feet deep. Within the ultramafic areas in these streamtypes much of the bank is armored with durable cobble and boulder material. Where POC trees line the banks, their roots are often undercut, providing instream cover for fish. Since dead POC is resistant to decay, there may be little difference in streambank stability compared to living POC when the overriding forces of streamflow are considered.

Large woody debris. Large wood is recruited from streambanks or transported downstream by debris flows or floatation during high flows. Typical studies in western Oregon (McDade et al. 1989) show that source distance for old-growth conifer has a median distance of 34 feet and 87 percent fall within 82 feet of the stream. Maximum source distance was 198 feet. Furthermore, 11 percent of all woody debris originated from 3 feet of the bank. Fluvial erosion and bank undercutting could be responsible for part of this observed supply. Researchers have shown that for mature and old-growth coniferous forests, that wind and tree mortality are the principal agents in initiating treefall (Lienkaemper and Swanson 1986).

POC large woody debris has tremendous longevity. For example, standing dead cedar in dendrochronology studies was routinely over 100 years old and one snag was dated to 264 years old (Jules et al. 2002). Dead wood that is subject to wetting and drying cycles and microbial decay in air breaks down faster than when buried in streams. In a study in western Washington, 80 percent of coniferous wood added to a channel was depleted within 50 years, although some wood was buried in the floodplain to be exposed centuries later by stream migration and dated at 1,400 years old (Hyatt and Naiman 2000). POC is expected to have long depletion times; much longer than reported for other coniferous species, whether spanning the channel or buried with sediments.

Large woody debris in moderate width B channels adds important structural elements that erode or protect banks, change flow direction and velocity, influence deposition zones, and scour pools. The debris adds cover and complex habitats for salmon and trout. The large woody debris is normally retained if its length is at least 1.5 times the channel width or includes a rootwad on the bank. In larger C and D channels, large woody debris is floatable and is moved downstream and can become embedded in jams. The debris is lodged near the high waterline on the outside of channel bends or on mid-channel bars and can initiate meander cutoffs. Secondary channel systems formed are primary areas for salmonid rearing because they provide off-channel refuge during high flows. The structural function of large woody debris, as described above, creates instream habitat complexity, which influences macro-invertebrate diversity and productivity. Small woody debris and fine organics are retained in a properly functioning stream and act as substrate and nutrient supply for fish prey species.

Stream temperature. Stream temperature is based on an array of physical and ecological processes. Summertime temperatures are of interest because thermal loading can elevate stream temperatures beyond optimum (14.5° C [58° F]) for salmonids and other aquatic life. The desired water temperature for salmonids during spawning is less than 13° C (55° F). Juvenile rearing salmonids can tolerate diurnal flucuations of 10° C without seeking cooler water if the daily minimum temperature is well within the optimum range (Meehan 1991).

Streams with limited canopy that are exposed during the winter months can have energy losses and a decrease in stream temperature. In most of the Oregon and northern California region, except for areas further inland and at high elevations, temperature losses are minor. This is due to nighttime cloud cover and normally moderate air temperatures (Beschta et al. 1987).

Average dry season precipitation (May–September) varies from 7 inches in the Northern Coastal Region, 9 to 18 inches in the Siskiyou Region, and 4 to 5 inches in the Inland Siskiyou Region (Oregon State University 1982). Mid-summer is even drier and streamflows recede in the POC region to about 0.22 cubic feet per second per mile square by July–August. The sun’s vertical position (zenith angle) is higher in the summer and its horizontal position (azimuth) is more northerly. These interactions of solar physics result in greater incoming direct-beam solar radiation and this is the most important factor influencing summer stream temperature change (Brown 1969). Greater available solar radiation, peaking in June–August, coupled with low flows, can result in lesser stream buffering capacity to maintain temperature.

Depending on the sun's path and time of day in summer, trees and shrubs and topography cast shade on streams. When the sun is high, trees closest to the stream provide shade, and as the suns position lowers, vegetation farther from the stream intercepts radiation and casts shadows. Shade is often used as a surrogate for temperature because when shadows block the sun there is much less heat energy gain (Beschta et al. 1987). Depending on the riparian site (including, topography, stream orientation, tree height, tree overhang, canopy density, stream width, stand composition, and relative abundance of POC infected with PL) lesser shading may or may not result.

Angular canopy density, a measure of shade quality, can be used to track changes in shade from forest vegetation. Old-growth coniferous stands in western Oregon average 80–90 percent angular canopy density (85–90 percent shade) and undisturbed riparian coniferous forests in northern California average 75 percent angular canopy density (80 percent shade) (Beschta et al. 1987). Shade greater than about 80 percent, may have no further effect on stream temperature decrease (Boyd 1996).

Shade calculations are complex, but available computer programs for shade simulation (Boyd 1996; Park 1993) can ease laborious hand calculations. Chris Parks SHADOW Model vs. X-15 was used to simulate a general shade scenario for uninfected mid-drainage and valley streams on ultramafic parent material. The north-south, intermediate, and east-west orientations were modeled. Results showed that if POC was the dominant riparian cover present (as may be the case in many ultramafic riparian plant communities), then 86 percent, 88 percent, and 88 percent shade would exist along the mid-drainage streams using the three aforementioned stream orientations, and 70 percent, 69 percent, and 49 percent shade would exist along the valley streams. Furthermore, the model predicts a temperature rise of 1.4° C–1.6° C per mile for the mid-drainage streams and 1.8° C –3.0° C per mile for the valley streams with the predicted shade cover (see Appendix 9).

Modeled shade results should be used cautiously. Factors changing shade values or stream temperature effects may include: (1) site factors; each shade reach has its own specific attributes that should be modeled; (2) secondary shade trees of another species, set back from the water's edge, perhaps on stream terraces, can increase shade above the modeled predictions; (3) lateral adjustment of streams by bankcutting can increase or reduce shade; (4) effects of riparian shade on valley streams decrease with increasing distance from the stream bank when influenced by channel confinement and floodplain development– this may lead to a natural conditions equilibrium temperature in these stream types because vegetation has less control on temperature rise; (5) mixing of bank stored water in river alluvium with the stream can lower stream temperature; and (6) water withdrawals can increase stream temperatures.

303(d) Streams

There are many Oregon Department of Environmental Quality listed 303(d) stream segments for temperature in the region. The listings are in the approximate lower 5 river miles of most streams except for larger rivers. Because of many site variables (see Chapter 2), a site-specific analysis of each riparian plant association with an assemblage of POC would be required to determine if, and to what degree loss of canopy density may have on stream temperature.

Effects of the Alternatives

Hydrology/Fisheries Interactions

Inoculum would continue to be introduced into flowing water by spread vectors under all alternatives. The probability, timing, and spatial distribution of the new occurrences vary under the alternatives. Some alternatives apply more stringent control measures in an effort to limit the current infestation.

North Coast Risk Region (Coos Bay District, BLM, Powers RD, Siskiyou NF). POC is a scattered minor component of riparian associations. Since the infestation has been in the north area the longest (more than 50 years), nearly all streams (75 percent) have become infested (refer to Table 3&4-10 in the Pathology section). Approximately 20 percent of known POC distributions are in high-risk sites along streams, floodplains, bogs, fens or other low and depressional areas, or downslope from infected areas. It is estimated that an additional 10 percent of uninfected POC in these high-risk sites would become infested in the next 100 years under Alternatives 1 and 2, 5 percent under Alternative 3, and 20 percent under Alternatives 4 and 5 (refer to Pathology section).

The loss of POC under any of the proposed alternatives would not have a detectable effect on fish in this region. POC lost to PL in riparian zones would gradually be replaced by those of other conifer species (refer to Ecology section). Summer temperatures and large woody debris recruitment would be maintained within the natural range of variability in headwater streams and mid-drainage and valley streams (see discussion below).

The Siskiyou Risk Region (Siskiyou NF in Oregon and Six Rivers, Klamath, and Shasta-Trinity NF in California). This region has seen increasing spread of PL in POC along roads and down streams in recent years. Many POC in the valley bottoms are old and range 20 to 60 inches in diameter (refer to Background section). Estimates are that 40 percent of known POC distributions are in high-risk sites along streams, floodplains, bogs, fens, or other low and depressional areas, or downslope from infected sites (refer to Pathology section). It is estimated that 23 percent of the high-risk sites are infested. Modeling shows that an additional 29 percent of POC areas in these high-risk sites would become infested in the next century under Alternative 1, 27 percent under Alternative 2, 14 percent under Alternative 3, and 62 percent under Alternatives 4 and 5 (refer to Table 3&4-10).

The loss of POC on headwater streams in this region under any of the proposed alternatives will not have a detectable effect on fish because summer temperatures would not be elevated and the function of large woody debris transport would be maintained. Loss of POC on mid-drainage and valley streams within the non-ultramafic portions of this region would not have a detectable effect on fish for the same reasons stated above in the Northern/Coastal Region (i.e., other conifer species gradually replace POC, and summer temperatures and large woody debris function are maintained).

Mid-drainage and valley streams within ultramafic areas of this region would be affected by the loss of POC. Because POC mortality on these streams is not predicted to disrupt the recruitment of large woody debris (see following discussion), no effects to fish are anticipated related to its function (e.g., pool formation, instream complexity, gravel recruitment). However, the loss of POC stream shade and the associated elevation of summer temperatures on these streams would have an indirect short- and long-term effect on fish. For steelhead and most salmonids this effect would not be significant under any alternative because of the very limited habitat area it involves, the small contribution to the population the affected fish make, and the ability of steelhead and resident trout to move and vary their production (see Cumulative Effects discussion).

Coho also would be affected indirectly in the short and long term by elevated summer temperatures within ultramafic areas of this region. From Alternative 1 to 3, the area affected decreases as the 100-year high-risk riparian infestation prediction decreases to the lowest percentage (37 percent) in Alternative 3 (Table 3&4-10). Because PL kills almost all of the POC trees that become infected, under Alternative 1, 52 percent POC infestation would mean that half of the drainages could be affected by elevated temperatures due to shade loss (not that all drainages would lose half of the shade produced by POC). Under Alternative 2, this would be the case also, as 50 percent POC infestation is predicted. Under Alternative 3, the fewest drainages would be affected, as the POC mortality predicted is 37 percent. The indirect effect to coho from elevated temperatures would be about the same under Alternatives 1 and 2, and it would be the least under Alternative 3. Under Alternatives 4 and 5, the 100-year high-risk riparian infestation prediction of 85 percent would mean that most of the drainages in the area would be affected by elevated temperatures, and the effect on coho would be the same under both alternatives.

The elevation of summer temperatures would be likely to decrease production and survival in coho in the drainages affected by POC mortality. The fewest drainages would be negatively affected under Alternative 3, more would be negatively affected under Alternatives 1 and 2, which would have about the same effect, and the most drainages would be negatively affected under Alternatives 4 and 5, which would have the same effect (not including positive effects from any resistant stock planting). The Illinois River anadromous fisheries are a stronghold for wild anadromous fish repopulation in the Rogue Basin. The majority of wild coho in the entire Rogue Basin spawn in the Upper Illinois River. The ultramafic portions of the upper watershed are thought to be of less importance to coho production than the non-ultramafic portions. Ultramafic-influenced streams are not characterized as providing optimal salmonid habitat (USDA and USDI 1997; RVCOG 1996). The impact to coho cannot be quantified within the scope of this analysis. Although the relative importance of the ultramafic areas to coho production has been estimated, the significance of the predicted impacts to coho from the proposed alternatives cannot be determined in relation to the status of southern Oregon/ northern California coho.

The Disjunct California Region has POC in highly scattered drainages in different vegetation types and often confined to riparian areas. Infection incidence is less than 10 percent. Estimates are that 40 percent of known POC distributions are along streams, floodplains, bogs, fens, or other low and depressional areas, or downslope from infected sites (refer to Pathology section).

Inland Siskiyou Risk Region (Medford and Roseburg BLM Districts). POC is scattered on the Roseburg District in the coast range to the Umpqua Basin. POC on the Medford District is primarily associated with riparian areas, particularly on the Grants Pass BLM Resource Area (refer to Background section). Estimates are that 60 percent of known POC distributions are in high-risk sites along streams, floodplains, bogs, fens or other low and depressional areas, or downslope from infected sites (Goheen, D.J., personal communication). It is estimated that 15 percent of the high-risk sites are infected. Modeling shows that an that an additional 33 percent of POC areas in high-risk sites would become infested in the next century under Alternative 1, 30 percent under Alternative 2, 17 percent under Alternative 3, and 68 percent under Alternatives 4 and 5 (refer to Pathology section).

In the Roseburg portion of the region, the loss of POC under any of the proposed alternatives would not have a detectable effect on fish. POC lost to PL in riparian zones would gradually be replaced by those of other conifer species (refer to Ecology section). Summer temperatures and large woody debris recruitment would be maintained within the natural range of variability in headwater streams and mid-drainage and valley streams (see following discussion).

In the Medford portion of the region, the loss of POC on headwater streams under any of the proposed alternatives would not have a detectable effect on fish because summer temperatures would not be elevated and the function of large woody debris transport would be maintained. Loss of POC on mid-drainage and valley streams within the non-ultramafic portions of this region would not have a detectable effect on fish for the same reasons stated above for Roseburg.

The loss of POC stream shade and the associated elevation of summer temperatures in mid-drainage and valley streams within ultramafic areas of this region would have an indirect short- and long-term effect on fish. The effects are the same as described above for the mid-drainage and valley streams within the ultramafic areas of the Siskiyou Region.

Headwater Confined Stream Channels (1st and 2nd Order Streams)

Channels in these watershed and landform positions, on smooth to steeply dissected descending sideslopes, share several stream and riparian attributes common to all alternatives. These channels are most often intermittent or ephemeral. Since these channel types are laterally constrained by hillslopes and streamflow is vertically contained in the channel, only POC that is not already dead and in or near the water column would be affected. There may be some spatially distributed ongoing declines in root strength with infected POC, which could affect bank stability. However, this effect is localized and is not expected to significantly increase slumps or entry of colluvial material into the channel. Windthrow of dead POC would provide a beneficial effect by increasing the hydraulic roughness and creating a random-to-stepped stream profile. However, POC may persist as standing snags for many years before toppling. Stream large woody debris would have very long persistence and create sediment reservoirs with incorporated organic material. The streamside large woody debris recruitment rate would remain within the range of natural variability. POC overhanging the channels affected by PL would have small pocket areas of an estimated 10 to 15 percent canopy density provided by boles and branches. Winter and spring stream temperatures would remain unchanged. There would essentially be no effect on summer stream temperature relations. This is because these stream types are above the water table and go dry during the warm summer months when stream heating is at a maximum. A summary of riparian and stream attributes in differing morphologies and relationship to PL is shown in Table 3&4-18.

Variable implementation of selected management activities (current direction) under Alternative 1 may have a slight short and long term positive effect, on lessening the spread of the pathogen through water, when compared to Alternatives 4 and 5. The geographic position of

Table 3&4-18.—Riparian and stream attributes in differing morphologies and relationship to Phytophthera lateralis these headwater channels (in many cases in steep topography above roads or greater than 40 feet from roads) would "de facto" slow pathogen spread to animal or human carriers. Additionally, projects within the Riparian Reserves require Aquatic Conservation Strategy consistency. Current management direction regarding POC would be taken into consideration during these analyses.

Management Practices under Alternative 2 are applied in a more structured approach by application of the POC Risk Key. Although the standards and guidelines in Alternative 1 use the elements of the risk key, the effects of Alternative 2 may be slightly improved in the short and long term. Systematic planning, direction of limited resources, and operational consistency in avoiding, sanitizing, or eradicating POC may result in lower spread of the infection. Management Practice 1 (project scheduling during the dry season) would slow PL resting spore transfer to water because road ditches and 65 to 80 percent of the stream network would be dry. Management Practice 2 (using water from known uninfected sources or treating water) would limit spore dispersal into flowing streams. Management Practice 9 (road management measures with a system of road closures in the wet season and eradication along selected roads) could substantially decrease water entry points particularly into roadside ditches and stream crossings. This would effectively reduce up to 50 percent stream extensions by roads. Management Practice 13 (washing project equipment) when implemented with Management Practices 1 and 9 may be very effective in separating inoculum from watercourses.

Alternative 3 (applies mainly to the Inland Siskiyou Risk Region) is expected to aggressively protect specific headwaters uninfested POC core areas by minimal entry, no timber harvest, and eradication. Since many of the 32 6th field subwatershed core areas are above roads, this would assure that transport of the PL spores would be unlikely to spread by project activities. This alternative would have a slight beneficial effect on retaining the flow of litter and nutrient inputs, and tree overhang with canopy shading in the short and long term. This condition should maintain intermittent stream winter and spring water temperatures from being cooler than normal and buffer against higher day night temperature swings. Furthermore, natural large woody debris recruitment over temporal and spatial scales in the range of natural variability within the riparian zone has a better chance of occurring. This in turn would trap sediment and organic material and buffer downstream reaches from sediment pulse inputs from infrequent floods.

Alternatives 4 and 5 are similar to each other in that no specific management measures would be applied, other than a POC resistance breeding program in Alternative 4 and general discontinuance in Alternative 5. Effects on water and aquatic resources, above highest road crossings, would be similar to Alternatives 1 and 2 in the short and long term. Effects to POC mortality below roads would likely be greater in the short and long term because there is no containment strategy for PL spread. Even though seed is available for planting resistant stock in the North Coast Risk Region, many sites are inaccessible, small, and not likely to be replanted. Additionally, edaphic conditions suggest that other tree species can easily occupy the sites in this region. Seed would not be available for planting resistant stock in much of the Siskiyou Region until 2010 and is not planned under Alternative 5. Many sites are inaccessible and not likely to be replanted. Seed would not be available for planting resistant stock in the Inland Siskiyou Risk Region under Alternative 4 until 2010 and would not be planned under Alternative 5.

Several regional differences by stream type and watershed position that could influence hydrologic/aquatic effects from loss of POC are summarized in Table 3&4-19. In headwater channels of the Northern/Coastal Region, stream debris flows and torrents occur in the sedimentary formations on steep dissected slopes. Presence of dead POC may or may not increase the rate of debris flows over natural levels, because the tree is a minor species in relative abundance and is not likely to affect the matrix of tree roots that hold the banks together. Selection of an alternative should have no effect on the chronic loading with debris and sediments and episodic excavations as debris flows.

In the Siskiyou Risk Region, higher surface rock content may lead to some overland flow and higher drainage densities during storms. Some non-channel related POC might be vulnerable to infection, particularly in those areas below roads where drainage relief culverts could spread water on the way downslope to a channel. Furthermore, seasonal intermittent snow accumulation and rapid melt above 2,000 foot elevations could cause some overland flows in this region. Alternatives 3 and to a lesser extent Alternatives 2 and 1 would best protect uninfested POC stands in near channel upslope areas.

Mid-Drainage to Valley Moderately Confined and Unconfined Stream Channels (3rd Order+ Streams)

Several riparian zone and stream attributes are common to all alternatives in these landforms and channel types. The streams are mostly perennial and have year-round flow. There is a lower incidence of stream-road crossings, but these are larger streams with many parallel roads and road-ditch stream connections, indicating probable infection entry points. Furthermore, these channel types are subject to water spreading during flooding by overtopping the normal channel. The severity of flooding depends on stochastic precipitation events that would control the widths of the floodprone area where new infestations could occur. Declines in root strength from standing POC mortality may lead to windthrow or localized undercutting by stream currents, especially on the outside of channel bends. This is expected to have beneficial effects for aquatic habitat by providing increased pool depths, complex habitats and cover. However, if too wide of an area of dead POC is present the stream may move laterally across the floodplain, the channel may widen and may not be in equilibrium. POC trees that topple into the streams would create scour pools in the medium width channels and become parts of jam complexes or distributed on the floodplains in wider channels. A summary of riparian and stream attributes in differing morphologies and relationship to PL is shown in Table 3&4-18.

In the North Coast Risk Region POC is a minor species and widely scattered in the riparian area. Many larger streams do not have floodplain connectivity (F type channels), which would limit the waterborne spread of PL into riparian POC. Where floodplains are present, other species of conifers or hardwoods would quickly replace infected POC where there are dead crowns and localized holes in the canopy. Edaphic conditions are generally favorable and there is very high competition for light. Replacement species should phase in as infected POC diminish. Effects on stream temperature would likely be within the range of natural variability, regardless of alternative selected. Alternative 3 would have no effect in this region because there are no uninfected 6th field watersheds.

In the Siskiyou and Inland Siskiyou Risk Region infected POC with dead crowns may contribute to more expansive holes in the canopy in riparian areas along streams. Infections

Table 3&4-19.- Regional hydrologic/aquatic differences and effects from Port-Orford-Cedar-infection of POC with PL would result in lesser amounts of shade than a healthy stand. Cedar trees that undergo PL mortality still have branches and boles that remain standing for many years. Field studies show that canopy density for this condition on the Siskiyou NF to be in the range of 10 to 15 percent (Park, C., personal communication). On soils derived from ultramafic materials, shading may be reduced for long time periods. Other tree species have difficulty occupying the site due to waterlogged soils with unfavorable chemistry. Western white pine can occupy these sites but is susceptible to white pine blister rust (refer to Ecology section).

POC mortality causing shade loss would be greater where standing water or wider floodplains are present, inoculum is present, and POC is more open grown with a high relative abundance. Mortality may elevate summer stream water temperatures. The amount of temperature increase would depend on stream and site factors, the extent of POC abundance, whether POC is along the stream (primary shade) or further back on the floodplain (secondary shade) and the severity of the infestation. The north-south, intermediate, and east-west orientations were modeled for shade loss with POC mortality. Assumptions and results are shown in Table A9-2, Appendix 9. Shade modeling suggests that shade in mid-drainage streams may decrease by 9 to 14 percent, and 9 to 19 percent in valley streams. Further, stream temperatures in mid-drainage streams may increase 1.1 to 1.6° C per mile and 0.5 to 1.2° C per mile in the valley streams. The degree of change modeled would be greatest for Alternative 5; the other alternatives would have lesser change. Partial mortality or stands less than 100 percent POC cover would yield a greater shade estimate and lower temperature rise estimate. However, this condition is more difficult to model and data should be field collected. Modeled shade results should be used cautiously (refer to the affected environment for further explanation). For comparison, numerous watershed studies in the coast range of Oregon for clearcut harvesting show maximum temperature increases of 3° to 8° C (Beschta et al. 1987).

Alternative 1

Implementation of selected management activities (current direction) under Alternative 1 may have some effect on lessening the spread of the pathogen through water by limiting pathways for entry or eradicating infestation centers that could reinfect healthy cedars downstream. Most mid-drainage and valley streams have chronic infection present, being more pronounced in the north and less infested in the south and inland parts of the POC range. This alternative would most likely be more effective than Alternatives 4 and 5, but slightly less effective than Alternatives 3 and 2 in the short and long term.

There is some risk to fish from the use of Clorox. PL-contaminated waters used for washing and firefighting will be disinfected with a 50 parts per million concentration of sodium hypochlorite, the active ingredient in Clorox bleach. Rainbow trout (*Salmo gairdneri*) exposed to a 30 minute dose showed an LC50 (the concentration lethal to 50 percent of the test population) of .43 parts per million, while 5 minute exposures resulted in a LC50 of 1.65 parts per million (Brooks and Seegert 1977). Wash stations would be located to avoid direct flow of treated water into streams and other bodies of water, so there should be little or no effect to fish from that source. Direct input of chlorinated waters could result from fire suppression activities and would be small in scale and of short duration. Free chlorine ions rapidly combine with organic material and are rendered non-toxic. See Appendix 4 for additional information about Clorox.

Alternative 2

Management Practices under Alternative 2 are applied in a more structured approach by application of the POC Risk Key. Although the standards and guidelines in Alternative 1 use the elements of the risk key, the effects of Alternative 2 may be slightly improved in the short and long term. Systematic planning, direction of limited resources, and operational consistency in avoiding, sanitizing or eradicating POC may result in lower spread of the infection. Management Practice 1 (project scheduling during the dry season) would slow PL resting spore transfer to water because road ditches and 65 to 80 percent of the stream network will be dry. Management Practice 2 (using water from known uninfested sources or treating water) would limit spore dispersal into flowing streams. However, if Clorox is used to treat water and there is an unintentional spill into surface water there may be harmful effects on fish and aquatic life. Management Practice 9 (road management measures with a system of road closures in the wet season and eradication along selected roads) could substantially decrease water entry points particularly into roadside ditches and stream crossings. This would effectively reduce up to 50 percent stream extensions by roads. Management Practice 13 (washing project equipment) when implemented with Management Practices 1 and 9 may be very effective in separating inoculum from watercourses.

The Clorox risk discussed in Alternative 1 applies to Alternative 2 as well.

Alternative 3

Alternative 3 incorporates the features of Alternative 2 and adds additional measures to control the spread of PL within 32 currently uninfested subwatersheds. Most of these POC core areas are in headwaters positions and may have a limited effect downstream other than slow spore transport and reinfection to mid-drainage and valley stream segments. The buffer strategy of the cores encompassing the 6th field watersheds may yield a slightly higher protection over Alternatives 2 and 1 in the short and long term. POC stands in the valley bottoms on ultramafic soils tend to be large diameter trees (greater than 20 inches diameter) with greater abundance (refer to Background section). Uninfested stands would maintain water quality; particularly preventing summer stream temperatures from increasing and maintaining a continuous supply of large woody debris as well as providing bank stability.

The Clorox risk discussed in Alternative 1 applies to Alternative 3 as well.

Alternatives 4 and 5

Alternatives 4 and 5 are similar in that no specific management measures would be applied, other than a POC resistance breeding program in Alternative 4 and general discontinuance in Alternative 5. In the Northern/Coastal Region effects on water and aquatic resources would also be similar to Alternatives 1 and 2 in the short and long term. This is because POC is a minor riparian species in this region and 75 percent of the riparian areas are already infected in many of the lower drainages. Additionally edaphic conditions suggest that other tree species can easily occupy the sites in this area. Seed is available for this breeding zone and could be planted in select areas. The planted POC would be small and not provide effective shade or large woody debris recruitment for many decades. Alternative replacement species including hardwoods like red alder or conifers including western red cedar and western hemlock would most likely occupy the site.

In the Siskiyou and Inland Siskiyou Risk Regions, Alternatives 4 and 5 would be less favorable than Alternatives 1, 2 and 3 in the short and long term. Currently about 23 percent and 15 percent respectively of POC of high-risk riparian areas are infested. The Pathology section describes that an additional 62 percent and 68 percent of these regions will become infested in the next 100 years under Alternative 4 and 5, while 14 to 30 percent will become infested under Alternative 3 and 2 in the same period (refer to Pathology section). Seed would not be available for planting resistant stock under Alternative 4 until 2010 and is not planned for some areas under Alternative 5. If resistant stock succeeds, Alternative 4 may ultimately become more important in a longer time frame than Alternative 5. The effectiveness of a resistance-breeding program in growing large POC is unproven, because the effort has only been operating for about 10 years.

Summaries of several regional differences by stream type and watershed position that can influence hydrologic/aquatic effects from loss of POC are summarized in Table 3&4-19.

Effect of private intermingled lands

Reciprocal rights-of-way on the Coos Bay, Roseburg, and Medford BLM Districts limit access control with private landowners and effective control strategies. Some roads will remain open and management direction in Alternatives 1 and 2 cannot always be implemented. Management Practice 13 (vehicle washing of Federal equipment) may reduce, but not eliminate, spore transfer to water.

Cumulative Effects

POC predicted mortality along streams in the next 100 years ranges from 32 percent to 95 percent. In the North Coast Risk Region sedimentary rock derived soils, the loss of POC influencing shade or large woody debris recruitment on perennial streams is not anticipated to be measurable. Scattered distribution of POC and aggressive naturally occurring alternative species replacement are expected to continue these processes. A gradual transfer of shading from POC to other conifer and hardwood species would most likely occur as POC trees die. The effect on fish and aquatic resources from the loss of shade or change in large woody debris supply from POC mortality would also be undetectable at multiple watershed scales (5–7th field hydrologic unit codes).

In the ultramafic riparian areas of the Siskiyou and Inland Siskiyou Risk Regions, POC comprises on average 50 percent of the overstory cover in plant associations where it is prominent in the overstory (refer to Table 3&4-13). The predicted increase in summer temperatures from the loss of POC stream shade in any one stream may not produce immediate effects on salmonid production. However, the cumulative effects from several tributaries can result in loss of mainstem rearing habitat downstream (USDA 1985). Streams on public lands play an important role in the survival of salmonids as they provide cool water to fish habitat lower in the system and provide refugia during summer months when water temperatures are lethal (78.4 degrees for coho) in the valley segments. The degradation of cold water refugia would have a cumulative effect on salmonid production and survival in the ultramafic portions of these regions because of the current degraded condition of valley segments due to elevated water temperatures, water withdrawals, and natural lack of flow. The magnitude of this impact must be analyzed in the context that it will only take place where POC cannot be replaced by other species. This is on the ultramafics, or serpentine areas, which are characterized by a lack of many of the attributes of optimal salmonid habitat (USDA and USDI 1997). The trend for cumulative effects under all alternatives is the same as previously stated for the ultramafic areas of the Siskiyou Risk Region, that is, Alternative 3 has the least effect, Alternatives 1 and 2 have an increased effect (compared to Alternative 3) and are almost the same; and Alternatives 4 and 5 have the greatest effect and are equal. Coho would be affected indirectly in the short and long term by elevated summer temperatures within ultramafic areas of this region. The elevation of summer temperatures would be likely to decrease production and survival in coho in the drainages affected by POC mortality. This impact is difficult to quantify within the scope of this analysis. Coho are an upper tributary spawner and most spawn in the upper Illinois River watershed. Approximately 40 percent of the area of the upper Illinois River, and perhaps 25 to 30 percent of the stream miles, are on ultramafic soils (USDA and USDI 1997; USDA and USDI 2000). These soils are by far the least productive areas, however. For example, it is estimated only 10 percent of the Upper Illinois coho production comes from the ultramafic-dominated West Fork, and even that is mostly trackable to the non-ultramafic Elk Creek. The percentage of coho coming directly from ultramafic stream systems is probably less than 5 percent of the population. As noted above however, the effects of increased temperatures are not limited to the serpentine, but contribute to increased temperatures and effects on a larger scale. The precise significance of the predicted impacts to coho from the proposed alternatives cannot be determined from this analysis.

The impact to steelhead would be anticipated to be of the same magnitude as that of coho because only that portion of the region which is serpentine would be affected. As in the effects stated for the Siskiyou Risk Region, this would not be a significant impact because steelhead in the regions have a stable population and are less vulnerable due to their life history characteristics (scattered distribution, temperature tolerance, variable production, mobility and resiliency). The effects on steelhead are representative of resident trout as well. Chinook would not be impacted by indirect temperature effects on rearing habitat due to the timing of their use of the rearing habitat.

Wildlife

Affected Environment

As noted in the Background and other previous sections, POC is found in many different environments, from sea level to 6,400 feet, and in 64 plant associations. POC is commonly associated with moist areas; most commonly along riparian areas but also in wet areas in the uplands. POC typically occurs as single trees or small groups in the uplands; larger groups may be located in riparian areas and alluvial fans. POC can be prominent in stands occurring in administrative units in the central portion of the POC range. POC is capable of growing to a large diameter; in serpentine sites they may be the only source of large diameter trees, snags, and down wood. In plant associations found on ultramafic soils, POC may be a prominent overstory species, especially along riparian zones. In plant associations where POC is prominent, 54 percent of POC acres within the range of POC are on ultramafic soils, and 51 percent within Oregon (derived from Table 3&4-12). Ultramafic riparian plant associations with POC as a component (high-risk portion) constitute approximately 26 percent of the POC acres in the planning area where POC is prominent. POC occur on approximately 272,000 acres of forested habitat in Oregon and 307,000 acres range-wide. In the 130,000 acres where POC is prominent, POC may comprise 27 to 50 percent of the overstory cover, but is rarely the dominant species (see Table 3&4-13). Within many ultramafic associations that contain POC, approximately 58,300 acres in Oregon and 70,000 acres range-wide (Table 3&4-12), POC is a prominent overstory tree, and its loss could have a large impact upon the ecological functioning of those stands.

Chappel et al. (2001) identified two major wildlife habitat types within southwest Oregon: Westside Lowlands Conifer-Hardwood Forest and Southwest Oregon Mixed Hardwood-Conifer Forest. The Westside Lowlands Conifer-Hardwood Forest extends across western Oregon and isolating data specific to southwest Oregon out of the data matrixes would be impossible. Queries of BLM and FS biologists have failed to yield information that would indicate that any species is specifically tied to POC (Dillingham 2003; Miller 2003; Webb 2003a) or would be expected to be uniquely affected by the proposed alternatives. Therefore species occurrence and habitat association data will be derived based upon the Southwest Oregon Mixed Hardwood-Conifer Forest classification, the dominant type in the affected area. Johnson and O'Neil (2001) identified 226 terrestrial vertebrate species that occur within the Southwest Oregon Mixed Conifer-Hardwood Forest (Table 3&4-20). Wildlife impacts will be analyzed based upon species group and associated habitat elements. For many areas, POC has a keystone role in riparian areas (especially in ultramafic plant associations) and for providing down wood and snags (standing dead trees) (see the Ecology section for more information).

Effects of the Alternatives

Potential effects to species listed under the "Endangered Species Act" are (also) discussed in the draft biological evaluation in Appendix 7.

Alternative 1

Under the current strategy for managing POC and PL, very few activities have effects to wildlife habitat and the associated wildlife species. Habitat modifications and loss of POC in all stages during roadside sanitation efforts may occur. There are approximately 9 acres of potential treatment area per 1 mile of road, although this not all habitat. Much of the road-

Table 3&4-20.— Numbers of wildlife species associated with the Southwest Oregon-Mixed conifer habitat type [1] side sanitation area is within the original clearing limits of the road. The precise level of road treatments to occur is unknown, but it is expected to approximate that described in Appendix 2. Few snags are left adjacent to roads due to safety concerns. The removal of isolated or small groups of large diameter POC and their future as snags could affect up to 46 species of vertebrates that are associated with large-diameter snags.

The seasonal restriction/closure of certain roads would benefit wildlife by reducing disturbance to the adjacent habitat. Disturbance effects many species in a wide variety of ways causing them to move away from roads, increasing stress levels, predation, and nest abandonment, and reducing fecundity, depending upon the intensity, frequency, and duration of the disturbance. The closure of local and resource roads is expected to have minor landscape-scale wildlife benefits but may be important at a local scale. Note: (1) The rural local system primarily provides access to lands adjacent to the collector network and serves travel over relatively short distances (USDI 2002); and (2) the resource road system provides access for specific management actions and connects to local or collector road systems (USDI 2002).

PL-contaminated waters used for washing and firefighting will be disinfected by mixing 1 gallon of Clorox bleach to 1,000 gallons of water. This mixture results in a sodium hypochlorite concentration of 50 parts per million (milligrams per liter) (drinking water is about 2 parts per million). The toxicity level for sodium hypochlorite for freshwater aquatic species, as determined by EPA, is 0.011 parts per million 4-day average, or 0.019 parts per million for 1 hour (EPA 1984). Research into the control of zebra mussels (*Dreissena polymorpha*) showed it was an effective biocide at concentrations of 1 mg/L (1 parts per million) (Martin et al. 1993). Rainbow trout (*Salmo gairdneri*) exposed to a 30 minute dose showed an LC50 value of .43 mg/L at 20 C (0.43 parts per million) while triple exposures (or 5 minutes) resulted in a LC50 of 1.65 mg/L (Brooks and Seegert 1977). Wash stations would be located to avoid direct flow of water into streams and other bodies of water, so there would be little or no effects to aquatic amphibians from those sources. Direct input of chlorinated waters could result from fire suppression activities and would be small in scale and of short duration. Free chlorine ions rapidly combine with organic materials and are rendered nontoxic. See Appendix 5 for further discussion of Clorox.

Projections by pathologists indicate that 40 percent of the high-risk stands currently uninfested with PL will become infested under Alternative 1 by 2103, and that POC mortality in these infested stands would approximate 90 percent. Loss of individual large-diameter POC and small groups would be minor in the nonultramafic plant associations. In these stands, POC is not a dominant overstory species and canopy gaps created by the die-off would be quickly filled by other species. The increase in snags and down wood would benefit 46 and 57 species, respectively (Table 3&4-20). In 70,000 acres of ultramafic plant associations containing POC, POC is a prominent canopy species and may be a majority in some riparian plant associations. Infestation rates in 100 years in high-risk ultramafic riparian sites will be about 50 percent (Table 3&4-10), with mortality on these infested sites of about 90 percent. This mortality may cause measurable changes at a site-specific scale (such as changes in micro-climate), but should cause no effects at a landscape scale.

The development of PL-resistant stock would help to restore the POC losses. Available for deployment in 0 to 40 years depending upon seed zone (see Table 3&4-21 in the Genetics and Resistance section), large-diameter POC could be in the landscape again 80 to 100 years later.

Alternative 2

The effects of Alternative 2 are the same as Alternative 1 with the following exception.

Alternative 2 prescribes the use of a risk key for determining when mitigative measures are necessary to prevent/reduce the spread of PL. This risk key would standardize the implementation of mitigative measures and likely further reduce the infestation of drainages and the loss of POC.

Projections by pathologists indicate that 35 percent of the high-risk stands currently uninfested with PL will become infested under Alternative 2 by 2103. POC mortality in that 35 percent would approximate 90 percent. Potential effects to wildlife would be slightly less than in Alternative 1, but the overall conclusion remains the same. This mortality may cause measurable changes at a site-specific scale (such as changes in micro-climate) but should cause no effects at a landscape scale.

As in Alternative 1, the development of PL-resistant stock would help to restore the POC losses. Available for deployment in 0 to 40 years depending upon seed zone (see Table 3&4-21), large-diameter POC could be in the landscape again 80 to 100 years later.

Alternative 3

The effects of Alternative 3 are the same as Alternative 2 except as follows.

Provisions have been established to provide additional protection for 32 6th field watersheds that are currently identified as being uninfested with PL.

Timber harvests would be prohibited on 28,600 acres (Table 2-2) in the uninfested watersheds; this does not preclude salvage in the case of a stand-replacing event. Regularly scheduled timber harvests (those contributing to probable sale quantity), including regeneration harvests, would be prohibited on 2,300 acres of Matrix and Adaptive Management Area lands. Additionally, within POC cores all POC less than 10 inches dbh (diameter at breast height) would be removed along roads. These equates to about 9 acres per mile of road including previously cleared road clearing limits. The loss of these smaller diameter trees should have no effect on ability of the stands to function. There is the potential to restrict the recruitment of large diameter POC, but with the exception of ultramafic plant associations, POC is a minor component of the overstory. The restriction against timber harvest will restrict the ability of Agencies to do commercial thinning on approximately 6,000 acres of 40- to 80-year-old stands of Late-Successional Reserves in those uninfested watersheds in order to accelerate the development of late-successional forests or restore ecological processes. Such thinning is a major strength of the Northwest Forest Plan, but with nearly 2,000,000 acres of thinning needs in the Northwest Forest Plan area, this 6,000 acres is inconsequential to achieving Late-Successional Reserve objectives because of the small percent (0.3 percent) of this habitat compared with the Northwest Forest Plan area.

Projections by pathologists indicate 20 percent of the high-risk stands currently uninfested with PL would become infested under Alternative 3 by 2103, and POC mortality in these infested stands would approximate 90 percent. As with Alternative 2, loss of individual large-diameter POC and small groups would be minor in the nonultramafic plant associations.

In 70,000 acres of ultramafic plant associations containing POC, POC is a prominent canopy species and may be a majority in some riparian plant associations. Infestation rates in 100 years in high-risk ultramafic riparian sites will be about 35 percent (Table 3&4-10), with mortality on these infested sites of about 90 percent. This mortality may cause measurable changes at a site-specific scale (such as changes in micro-climate), but should cause no effects at a landscape scale.

The development of PL resistant stock would help to restore the POC losses. Available for deployment in 0 to 45 years depending upon breeding zone (see Table 3&4-21), large-diameter POC could be in the landscape again 80 to 100 years later.

Alternative 4 and 5

These alternatives remove all mitigation measures currently used by the BLM and FS to limit the spread of PL across the landscape. The alternatives differ only in the level of resistance breeding to continue. With Alternative 4, the current breeding and testing program for the development of resistant stock would be accelerated. Within 10 years resistant seed and planting stock will be available for all seed zones in Oregon. With Alternative 5, the further identification and testing of new resistant trees would cease, but use of resistant seed from the currently developed breeding zones would continue. These cover approximately 26 percent of the breeding zone.

Projections by pathologist indicate that 80 percent of the high-risk stands currently uninfested would become infested by the year 2103. Loss of individual large-diameter POC and small groups would be minor in the nonultramafic plant associations, with effects similar to those described for the other alternatives; they would be quickly replaced by other species. In 70,000 acres of ultramafic plant associations containing POC, POC is a prominent canopy species and may be a majority in some riparian plant associations. Infestation rates in 100 years in ultramafic riparian sites will be about 84 percent (Table 3&4-10), with mortality on infested sites of about 90 percent of the POC. This mortality would likely cause measurable changes at a site-specific scale (such as changes in micro-climate). However, in part because POC overstory contributes an average of 50 percent of the total canopy cover in ultramafic riparian sites where POC is prominent (Table 3&4-13), there should be no wildlife effects at a landscape scale.

The development of PL resistant stock of Alternative 4 and the continued use of PL-resistant stock would help to restore the POC losses— Alternative 4 more than Alternative 5. Large diameter POC could be in the landscape again 80 to 100 years following planting.

Ultramafic Soils

Affected Environment

The POC range includes just under 100,000 acres of ultramafic soils generated from serpentine and peridotite igneous rocks. These soils are characterized by a high iron and magnesium-to-low calcium ratio, severely restricting plant uptake of calcium and thus limiting the number of species that can survive and grow here. Many unique species grow here, either because they are adapted to the soils, or are not particularly dependent upon the soils (insectivorous), or have a competitive advantage because other species do not occur. POC does well in wet areas on these soils, in part because of its unique ability to extract calcium from these soils. POC does so well that it is often the largest, most dense plant present on these soils, and therefore, plays an important ecological role.

It has been suggested that POC's ability to retrieve calcium from ultramafic soils is an important soil-building characteristic that should be recognized and preserved. However, POC's ability to utilize soil calcium does not enrich soils, and although litter fall place calcium in a more usable form and location for other plants (Zobel et al. 1985), the effect is small (Powers, *personal communcation*). POC does not manufacture calcium the way some plants enrich soils by fixing nitrogen. The overall effect of POC on soil productivity is not materially different from having any other vegetation on these soils. Additional information about soils is included in the Water and Fisheries section.

Effects of the Alternatives

There would be no meaningful difference between the alternatives upon the status of the ultramafic soils or soil productivity. The indirect impacts due to POC mortality on ultramafic soils is discussed in the Water and Fisheries section.

Pacific Yew

Affected Environment

The Pacific yew tree and shrub is unique in western forests, growing inconspicuously either individually or in small groups in the understory of Douglas-fir and other conifer forests. Although important to American Indians and a small contingency of woodworkers, it was overlooked by modern society until taxol, a promising cancer fighting compound extracted from yew, was discovered. Demand soared, and in 1993 the FS and BLM prepared a joint EIS and record of decision describing the appropriate management of yew. Harvest accelerated for a few years, until a synthetic taxol virtually eliminated the need to harvest yew trees. Interest in natural taxol has recently resurfaced, and the future demand is uncertain.

As noted in the Pathology section, Pacific yew is infected by PL on infrequent occasions (Kliejunas 1994). It has been suggested this is cause for concern, and that this SEIS needs to address Pacific yew in detail, reevaluating the analysis made in the 1993 Pacific yew EIS. However, observations and laboratory trials show that Pacific yew is much less susceptible to PL than POC. Where it has been found infected, yew was growing in close association with many previously infected POC (Murray and Hansen 1997).

For the purposes of this analysis it is concluded there is no evidence that Pacific yew will carry PL on its own, or that PL poses a significant threat to yew.

Effects of the Alternatives

Pacific yew growing in close association with numerous POC will potentially be more susceptible to future PL infections. The potential for incidental Pacific yew growing on high-risk sites to become infected varies by alternative in proportion to the percent of POC predicted to become infected (Table 3&4-8). Within disease-infested areas, yew infections will follow the same infection patterns as those outlined in the Pathology section; that is, they will become infected on infrequent occasions. In all alternatives, overall yew infection rates are expected to be inconsequential.

Genetics and Resistance

Affected Environment

Genetic Variation

Genetic diversity among and within species is the basis for all biological diversity. Most plant species exhibit a large amount of genetic variation, which reflects adaptation to local environmental conditions (Linhart 1995). Paleobotanical evidence indicates that POC formerly occupied a vastly wider range and that restriction to its present distribution left considerable variation intact (Edwards 1985). Such diversity is an asset in allowing a species to survive and adapt to new, changing environments (such as when POC as affected by PL) (Kitzmiller et al. 2003). Knowledge of the patterns of this variability is crucial for successful genetic management, whether in designing elaborate resistance breeding programs, or in developing more passive, conservation strategies for natural ecosystems. Recent studies of this genetic variability can be grouped into two major categories: Allozyme Studies and Common Garden Studies.

Allozyme studies. Electrophoretic analysis of allozymes allows relatively quick, inexpensive quantitative measures of genetic structure, genetic diversity, and mating systems. They are often employed as a first step in describing and understanding the genetic architecture of a species.

In three studies conducted on POC, populations in California were moderately variable in allozymes (comparable to values for other California conifers with small- to moderate-sized distributions, but notably lower than most widespread conifers). Across all stands, 5 percent of total allozyme variation was attributed to differences among stands, and 95 percent to differences among trees within stands (Miller and Marshall 1991). Elevation was the strongest ecological factor associated with genetic differentiation, but at low elevations, soil contrasts (serpentine versus nonserpentine) was nearly as great (Miller et al. 1991). Overall, relationships between ecological habitat, allozyme diversity, and genetic differentiation over short geographic distances were markedly greater for POC than for more widespread Douglas-fir and white fir (Miller et al. 1991). Sampling on a much wider scale showed contrasts between populations from California and Oregon (Miller et al. 1992). For example, while the mean allozyme diversity was slightly greater for Oregon, the range of diversity was greater in California. In addition, the Oregon cline among populations in allozyme variation was strongest along latitudinal, weaker along longitudinal, and weakest along elevational gradients. In California, the cline was strongest along longitudinal strata, although elevation was also a relatively strong determinant of allozyme diversity (Miller et al. 1992).

Collectively, these studies show that a large number of common alleles associated with allozymes reside in any given population. Therefore, even if scattered stands over the species' range were completely lost in the future, common alleles would not be compromised.

Such genetic makeup bodes well for gene conservation, as well as for the genetic effects of alternatives. Note: The convention on International Trade in Endangered Species (March, 1994) quoted the consensus of scientist working on POC:

> . . . to the best of our knowledge, POC has not been eliminated from any area because of the root disease.

The conclusion is still applicable in 2003.

Unfortunately, since allozyme analyses cannot show definitive, adaptive responses to field environments over time, their practical utility is limited. Investigations of these responses are best accomplished by common garden studies.

Common garden studies. As the name implies, common garden tests are often designed to compare variation patterns of a few to relatively large numbers of genetic identities (those being provenances, open-pollinated, or controlled-pollinated families, clones, etc.), all grown in at least one, but frequently several, test sites, or "gardens." By careful selection of genetic entries, choice of uniform garden(s) representing environmental gradients or extremes, proper experimental design and statistical analyses, and appropriate management, these research sites can yield a wealth of practical information about genetic variation. If maintained judiciously over time they may also allow evaluation of genetic adaptation to infrequent events (such as severe frosts, droughts, and new disease epidemics) or more subtle future changes (such as global cooling or warming).

In 1995 the BLM and FS began to establish range-wide, common garden tests to further evaluate the genetic variability within POC. Seed was collected from 344 healthy parent trees on Federal land between 1991 and 1994. Stands were sampled throughout much of the species' range; their selection assisted by results of the earlier allozyme studies, noted above. Two different hierarchical models were employed to partition the genetic effects: (1) ecological or watershed model with watersheds, stands, and families; and (2) a breeding model with breeding zones, seed zones, and families (Kitzmiller et al. 2003).

Short term studies of height growth response (Kitzmiller and Sniezko 2000), height growth phenology (Zobel et al. 2002), and water relations of terminal shoots (Zobel et al. 2001) were conducted, utilizing seedlings from families transplanted in raised beds at two nursery sites (Dorena, near Cottage Grove, Oregon, and Humboldt Nursery, McKinleyville, California) in 1996. Seedlots from the extremes (high elevation, southern interior in California and low elevation, coastal stands near Coos Bay) of the species distribution exhibited striking contrasts in all traits. Of more practical adaptive relevance, height growth increased, while the proportion of early-season growth declined and proportion of late-season growth increased with change in source location from (1) high to low elevations, (2) from south to north, and (3) from east to west when populations spanning the range were included. Strong clinal patterns were noted for height potential with source elevation, latitude, and longitude (Kitzmiller and Sniezko 2000). Overall these data showed population structure and geographic patterns similar to, but much stronger than the allozyme work, noted above (Kitzmiller et al. 2003).

Short duration tests in low moisture and nutrient stress nursery environments are not well suited to assess cumulative responses to complex, site-specific environmental stresses in forest settings. Consequently, five individual common garden sites utilizing 266 of the families included in the nursery tests were planted in 1996 to 1998. Data collected on the Humboldt and Trinity Lake plantations for 3 years showed mean height was inversely related to survival at the inland site. Data collected for 5 years revealed a geographic cline in height growth associated with latitude, longitude, and elevation of seed origin. Northern, low elevation, coastal provenances grew taller than southern, high elevation, interior sources at both plantations. However, these faster growing sources also showed the greatest relative reduction in growth and survival when planted at the inland site (Kitzmiller 2000, *unpublished*).

Growth measurements would continue, and deleterious, episodic events assessed and genetic effects evaluated as warranted. Even very harsh sites with poor survival have value. For example, Sharpe (2002) assessed drought-prone interior sites (Althouse and Trinity Lake) sites, as well as greenhouse, in her study of drought resistance and root regeneration of POC genotypes. Her findings generally supported those of Zobel et al. (2001); mid-day field water potentials were correlated with survival of seedlings from different breeding blocks. Root growth and morphology also varied among seed sources, with probable adaptive consequences (Sharpe 2002). These data could be helpful in designing PL resistance mechanism studies.

Overall, these POC genetic variability studies fit with the classical, theoretical population genetics theory of changing responses to mutation and genetic drift, as confounded by various selection pressures (over time and space) and by migration patterns and rates (Namkoong 1979, p.312). Practically, the gradual clinal trends collectively infer adaptive changes in gene frequencies across the species' range. These data were all considered in developing geographic subdivisions for POC (see Breeding Block and Zone Designations as follows). They are also fundamental in breeding strategy planning (see Program to Develop Genetic Resistance to *Phytophthera lateralis*: Selection, Testing, and Breeding section), for deployment of resistant seed (see Utilization of Resistance section), and for general genetic and silvicultural management practices.

Breeding Block and Zone Designations

A breeding block designates the geographic area that envelops a number of breeding zones. Preliminary breeding blocks and zones have been delineated on the basis of a short-term genetic common garden study (Kitzmiller and Sniezko 2000) and general knowledge of southwestern Oregon and northern California species genecology (Figure 3&4-2).

Genetic common garden studies are short- and/or long-term tests that are commonly used to assess seed transfer or breeding zones (Westfall 1992). The common garden study noted genetic variation associated with latitude, longitude, and elevation of the seed sources. These macro-geographic variables, in part, imply natural selection to temperature and moisture, which affects growth initiation, growth cessation, and growing season length and climatic gradients over the range of the species. Additional studies (Miller and Marshall 1991; Zobel et al. 2001; Zobel et al. 2002) have also noted differences between the coastal and inland sources of POC in relation to allozyme, phenology, and physiological traits. In addition, a long-term common garden field study was established between 1996 and 1998 to assess genetic variation patterns over a long timeframe. Future analyses of this study would be used to verify and/or refine the genetic variation patterns inferred from the short-term test.

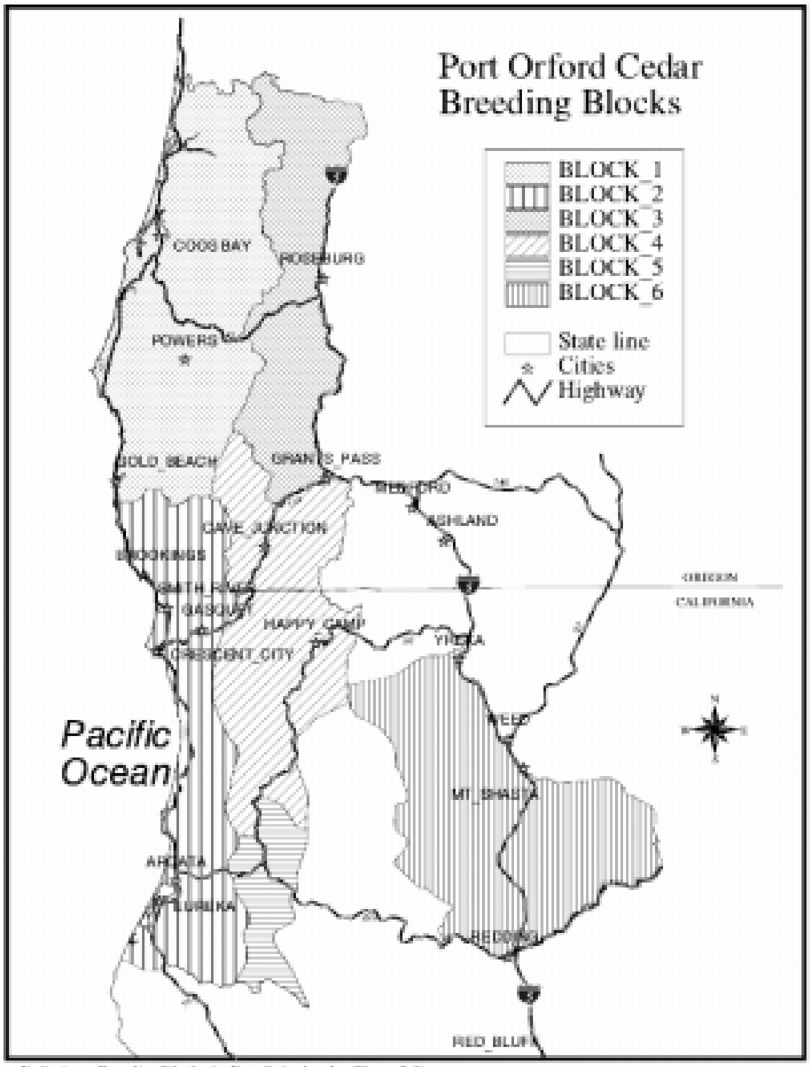

Figure 3&4-2.— Port-Orford-cedar breeding blocks

Breeding blocks and zones represent a geographic area where genetic reproductive materials (seed, seedlings, cuttings) are procured, and then subsequently deployed (seeded or planted). This insures that the seeded or planted stock are adapted to the deployed areas, and also helps conserve the natural genetic structure of the species over the landscape.

The preliminary breeding blocks and zones serve to guide seed transfer and associated breeding activities. Breeding zones are represented by elevation bands within the respective breeding blocks, and designate units of land in which seed transfer and improved populations (e.g., resistance breeding) are being developed. The elevation bands are listed in Table 3&4-21 (also see Figure 3&4-2). An elevation band within a breeding block constitutes a single breeding zone; all elevation bands are not represented in every breeding block.

Seedlots may also be delineated within any respective zone in the future on the basis of source soil type. POC occurs on both ultramafic (e.g., serpentine) and non-ultramafic soil types. A number of plant species have differentially adapted to these distinct soil types (Linhart 1995), but the degree to which POC has specifically adapted is not well known.

Conservation Genetic Considerations

Conservation genetics deals with the inherent genetic diversity of a species, and has been defined as the use of genetics to preserve species as dynamic entities that can evolve to cope with environmental change, and thus minimize their risk of extinction (Frankham et al. 2002, p. 19). Conservation genetics is especially relevant to the current POC ecosystem dynamics where populations are being fragmented to varying degrees as the disease spreads through portions of the landscape. The basic principles of genetics can be used to assess the effect on population structure. In addition, current or future conservation measures can be assessed as to their efficacy in conserving genetic diversity. This section will discuss aspects of the following: (1) effect on POC genetic structure where PL is spreading or has been in place; (2) general genetic effects of establishing resistant stock in restoration efforts; and (3) ex-situ and in-situ genetic conservation measures.

1) Effect on POC genetic structure where PL is spreading or has been in place: Population-level conservation is sufficient for both genetic and species conservation with a simple to very diverse structuring (Namkoong et al. 1988, p. 151). Population genetic structure refers to the amount and distribution of variation within and among populations. The genetic properties (and structure) are affected by population size, fertility, viability, migration (gene flow), mutation, selection, mating systems, and genetic drift in combination with environments (Falconer 1989, p. 6).

Many forest species adjust to repeated loss (such as through disease) and subsequent reinvasion (or recolonization) of its range (Stern and Roche 1974, p. 228). Change in genetic structure of populations can be summarized by the changes in allele frequencies, heterozygosity, and genetic variances. When populations are completely isolated from others (where there is no gene flow from pollen or seed), fragmentation would typically lead to greater inbreeding (reduced heterozygosity), loss of genetic diversity within fragments, loss of rare alleles, and greater risk of extinction of these populations (Frankham et al. 2002, p. 309). Fortunately, since extirpation has not occurred (see Note under previous Allozyme Studies section) nor is it predicted to in this analysis, the other genetic consequences may only be applicable in rare circumstances, mostly in very small disjunct inland locales with limited gene flow among stands.

A large segment of POC habitat can be described as a composite of numerous subpopulations (a deme or group of interbreeding individuals) where gene transfer (migration) occurs among subpopulations over time. The main factor relating to change in population structure is the rate of extinction of subpopulations and number and type of founder individuals that colonize the extinct subpopulations (Hedrick and Gilpin 1997). In addition, it is pointed out that the effective population size is increased when the rate of extinctions is reduced, and the number of subpopulations and rate of gene flow are increased. Selection pressures (as an evolutionary force) in any population will ultimately change allele frequencies to some extent. It is the combination of genetic processes that formulate both genetic structure and magnitude to which the structure changes over time.

Even after a severe PL invasion of prolonged duration, surviving natural POC persist and continue to exchange genes (both pollen and seed transfers) with neighboring subpopulations. A very analogous process would likely occur between resistant stock used to rehabilitate PL infestation sites and surviving POC from the same stand and others nearby, although gene flow may be limited and directional until planted trees reach reproductive capacity (see Genetic Resistance Program section) to balance natural trees.

When small, relatively isolated stands are considered (often referred to as the island or stepping-stone model) only small numbers of immigrants (~ 1; where 1 = [effective population size] x [percent of immigrants from other populations]) in any respective generation are required to prevent loss of alleles (prevent fixation by drift) and differentiation among populations (Falconer 1989, p.80; Namkoong 1979, p.308). When subpopulations are more continuously distributed over the landscape (neighborhood model typical of coastal conditions) and gene frequencies are more similar (among subpopulations), the effective population size must be on the order of 20 or less (circumstances not generally found in coastal subpopulations) for a large amount of local differentiation (Falconer 1989, p.80). Hence, in nature high genetic standards result for adaptability and species survival (fitness), but provides mechanisms or processes to promote genetic diversity/variation over time and spatial scales.

2) General genetic effects of establishing resistant stock in restoration efforts: Resistant stock can be deployed to various habitats throughout the natural range in order to help restore the habitats where the disease has occurred. Once disease resistance is obtained, it is useful, and it can be improved over time in an operational breeding program (Zobel and Talbert 1984, p.274). In addition to restoring the habitat, planting would help reestablish gene flow to a degree. This would enable pollen flow and migration (seed transfer) of selectively advantageous alleles/genes to be spread to adjacent subpopulations over time (Ledig 1986).

The genetic structure of the local or subpopulations would be dependent on the effective population numbers of the planted stock in addition to the various factors presented earlier (such as gene flow, number of subpopulations, etc.). The genetic structure over the species' range would probably not be changed much, since these plantings would not be on a scale sufficient to change effective population sizes over a large continuum of the range.

3) Ex-situ and in-situ genetic conservation measures: Gene conservation conserves and stores gene pools which in turn helps prevent the loss of genes, gene complexes, and genotypes (Zobel and Talbert 1984, p.461). In practice, application of gene conservation strategies, common genetic conservation measures that are undertaken to conserve genetic variation of a species, can be separated into two broad categories: (1) Ex-situ (saving genes offsite such as seed banks, clone banks, seed orchards), and (2) in-situ (management of populations onsite). Saving genes with efficiency, security, and completeness are the first objectives for conserving biological diversity, and ex-situ conserves genes more conveniently (Namkoong et al. 1988, p.152). In-situ continues the evolutionary process in the wild, but it may not be practical (Namkoong et al. 1988, p.152), or the natural stands may be vulnerable to damaging agents (such as disease) or catastrophic events (Ledig 1986). Thus, conservation measures are selected and put into place to meet specified conservation objectives.

a) In-Situ — Coastal Populations: Miller and Marshall (1991) suggested that in California, because of low allozyme distance among populations and high proportions of variability within stands, a few large (as opposed to many small) natural areas would conserve much of the genetic diversity in POC. The same conclusion should also apply to coastal Oregon populations. Indeed, even in stands that have been severely infested for 30 to 40 years, some seed bearing POC seem to survive, whether by favorable location on micro-habitat niches that escape infection, by random chance, or by some combination of heretofore undetected quantitative genetic resistance mechanisms. Furthermore, the precious and prolific seed production of POC (Zobel 1979), its relative shade tolerance and ability to establish itself on a variety of seedbeds (Zobel et al. 1985) seem to result in continued natural regeneration on these infested sites. On the Oregon coast, it appears that natural conservation areas are presently, functionally covered by Reserve and Withdrawn Land Use Allocations (Table 3&4-3).

b) In-Situ — Inland populations: Frequently disjunct, inland stands of POC have much smaller pre-infection effective population sizes, restricted gene flow with “neighboring” subpopulations, and a higher “average” predicted infection percentage (Table 3&4-10, Pathology section), as well as a likelihood of the occurrence of proportionally more rare alleles. Some notable stands and large acreages are also protected by Reserve or Withdrawn Land Use Allocation (Table 3&4-3). Examples include the Brewer Spruce Research Natural Area (RNA) southwest of Grants Pass; Beatty Creek RNA west of Riddle, Oregon; Caves National Monument; and Late-Successional Reserves. Riparian Reserves may be particularly unsuited for protection of POC, since they are often, by definition, high hazard sites.

c) Ex-Situ — Seed Collections: Several authors have noted that ex-situ collections can extend the range of genetic protection and reinforce in-situ programs (Miller and Marshall 1991). Ledig (1986) advised that ex-situ methods should be used when possible as added insurance against loss. Miller and Marshall (1991) recommended that seeds should be collected as soon as possible from main stands throughout the range, especially in infested areas and from dying trees.

They further noted that early evidence suggests that POC seeds may retain high viability for more than 50 years under proper cold storage conditions.

A substantial quantity of POC is available in operational reforestation seed lots. Over 120 pounds of seed, representing nine seed zones (with discrete elevation bands within them, ranging from 1,000 to over 4,000 feet), collected from over 250 wind-pollinated trees from natural stands are in storage at the five administrative units (Coos Bay, Medford, and Roseburg BLM; the Siskiyou NF; and the FS Dorena Genetic Resource Center). This broad-based store of locally well-adapted, but primarily nonresistant parents, all collected since 1989, is available for project work, rehabilitation following catastrophic events, and as operational baseline controls (for contrasts with bred, resistant stock). In some breeding zones, operational seed lots are rapidly being replaced by resistant seed from orchards, although the rate of conversion would vary by alternative (see Table 3&4-21 in Program to Develop Genetic Resistance section). Each production orchard at Dorena Genetic Resource Center also has a current goal of a conservation seed bank of 50,000 to 100,000 seeds, primarily for use in unscheduled restoration projects (following wildfires, for instance).

Open-pollinated cone collections from single trees of precisely known location formed the basis for many past genetics research projects, including the range-wide common garden study (see Genetic Variation discussion). Approximately 500 of these half-sibling families each retain at least 50 seed in storage. While their primary utility may be for additional research projects, they can also serve simultaneously as ex-situ genetic reserves. Dorena Genetic Resource Center also maintains an operating, expanding collection of full-sibling families, inbred lines, and a variety of other materials used in their work on breeding PL resistance.

d) Ex-Situ – Vegetative Material: There exist a number of ex-situ collections of clones/families which are preserved at various locales. Dorena Genetic Resource Center maintains a breeding arboretum of numerous clones, in containers. The BLM Tyrrell Seed Orchard, southwest of Eugene, Oregon, currently contains numerous clones, with 3 ramets per clone, in an “in-ground” clonebank. More room is available for expansion, as an offsite backup for Dorena’s material, as well as a longer-term repository.

The numerous validation plots established in the field (see Genetics section) also serve as repositories of known identity and pedigree. The range-wide common garden plantations also preserve half-sibling, open-pollinated families, as well as bulked reforestation lots. Finally, although their natural origins are largely unknown, the 50 or more cultivars currently still available commercially (Zobel et al. 1985) could be of interest, especially since their adaptability to a wide range of climatic extremes may be appreciated by horticulturists.

These materials represent a sampling of the gene pool, and preserve both resistant and non-resistant materials from across the species’ range. They would be utilized in the future breeding program to some extent, and help conserve the gene pool on a limited scale.

Program to Develop Genetic Resistance to *Phytophthora lateralis*: Selection, Testing, and Breeding

Nearly all seedlings and trees of POC are highly susceptible to PL. This is one reason for very high mortality levels (potentially 90 percent) on infested high-hazard sites in natural ecosystems. On these sites, very few, if any, seedlings would ever survive beyond the sapling stage. There appears to be genetic resistance within native POC populations, however, only a very small percentage of trees have complete resistance (probably less than 1 percent of trees) and only a low frequency of trees appear to demonstrate partial resistance or slower rate of mortality (further investigation is underway) (Sniezko, *unpublished data*). The rare, resistant trees are too scattered to expect natural interbreeding toward resistant stock without severely compromising genetic diversity in the high hazard areas. A resistance program coupled with restoration efforts can overcome this.

Based on initial indications of genetic resistance in the late 1980s (Hansen et al. 1989) and confirmation in cooperative work between the BLM, FS, and OSU in the early 1990’s (Sniezko, *unpublished*) an operational program to develop resistance was begun in 1997. Over 9,000 prospective resistant trees were selected between 1997 and 2001 on Federal and non-Federal lands (Bower et al. 2000; Sniezko et al. 2003b) funded in part by a special technical development proposal. Until the start of this program, only a handful of trees had been identified with complete resistance. By 2002, more than 100 trees had been identified with complete resistance (Sniezko, unpublished data). Traditional resistance breeding such as employed in the program allows bringing together stock from those present, and allowing them to pollinate each other to generate populations of diverse, adapted, and resistant trees without having to utilize the recently devised but controversial techniques used in the development of genetically modified organisms.

The resistance program is based at the FS Dorena Genetic Resource Center and is a cooperative venture between the BLM and FS. OSU provides disease testing facilities and further technical pathology input. The primary resistance test is a greenhouse root dip test of seedlings or rooted cuttings (Sniezko et al. 2003a). In the greenhouse, rooted cuttings of some field selections consistently show high levels of survival (usually 100 percent), while rooted cuttings of susceptible parents often show 0 percent survival (Sniezko and Hansen, unpublished data). Seedling survival in greenhouses can vary from 0 to 100 percent 9 months after inoculation depending on the family tested (Sniezko et al. 2002; Sniezko and Hansen 2000; Sniezko et al. 2003a; Sniezko et al. 2003b).

Field validation plantings have been established at more that 20 sites (Federal, county, and private cooperators), but most tests were established since 2000. The oldest field test (planted in 1989) is at Oregon State University's Botany Farm. The resistant clones (using rooted cuttings of parent trees selected at field sites) and a seedling family have shown good survival and little new mortality in the last 7 years (Sniezko et al. 2000). Nearly all of the susceptible clones died within the first 2 years at this site (Sniezko et al. 2000). Three-year results from one of the 2000 test series involving 26 seedlings families showed that short-term greenhouse testing correlated well (r = 0.65 to 0.84) with a raised bed test and with tests at two field sites (Sniezko, unpublished data). All four of these tests had moderate to high mortality levels (41 to 69 percent). Analyses of additional tests of this nature are underway, but at this point current data suggest the utility of resistant trees on high hazard areas would be good.

There is difficulty finding good tests sites on BLM and FS land that are available for planting, but other interested landowners (county and private) have recently provided sites. These validation tests would be followed over time to determine whether resistance holds up under an array of environments, as well as whether the resistance is durable.

Two of the earliest field selections have survived in high hazard areas infested with PL since the late 1980s. Progeny and/or rooted cuttings of trees with complete resistance have been repeatedly tested in short-term tests and have consistently demonstrated higher survival (50 to 100 percent) than the most susceptible trees (less than 10 percent). Complete resistance in POC is likely a form of major gene resistance (Sniezko, unpublished data), but it is unknown at this point whether there is more than one resistance mechanism for complete resistance.

Future breeding efforts would focus primarily on improving the levels of partial resistance as these traits are confirmed. Several generations may be needed to increase the levels of partial resistance to levels sufficient for field use. Under natural stand conditions this process would proceed slowly, if at all, due to the rarity of resistant trees and the pollination by susceptible trees outside the immediate high hazard areas. Fortunately, breeding generations for POC are relatively short (3 to 6 years or more depending on funding). Parents with partial resistance could also be easily added to orchard populations as desired. Resistance from a putative major gene(s) and the affiliated complete resistance already yields moderate to high survival (50 to 75 percent) and this resistance would generally be incorporated directly into the seed orchard populations. The potential addition of partial resistance would increase the diversity of resistant mechanisms and should bolster the durability of resistance. As feasible, the genetic base for each breeding zone would incorporate selections from throughout the breeding zone. Breeding strategy would be adaptive to take advantage of new findings on inheritance of resistance and to try to keep the genetic base of orchard populations broad. Seed production levels from orchards could easily and inexpensively be increased as needed to meet any Federal or non-Federal needs for resistant seed. Once resistant populations are established in the field it is anticipated that resistance in future generations of natural regeneration would be sufficient to sustain populations in areas of high hazard.

The biology of POC (Elliott and Sniezko 2000; Sniezko et al. 2003b) and high levels of interagency cooperation have allowed very rapid development of resistant populations and orchards for a few breeding zones (Table 3&4-21). Current estimates based on greenhouse and limited field tests indicate that 50 to 75 percent of the seedlings from orchards should survive areas infested with PL versus less than 5 percent of highly susceptible parents. The first resistant seed from seed orchards was available in fall 2002 (Table 3&4-21). If funding is available, selection and testing of additional resistant candidates would help establish seed orchards for additional breeding zones.

Work on the inheritance of resistance and field validation continues, directed by staff at Dorena Genetic Resource Center. With funding and plant materials from the BLM, FS, and OSU has undertaken a project to examine the underlying nature of some types of genetic resistance. Results from these projects and trials would help lead to more efficient development of resistant populations of POC. As new information becomes available it would be incorporated. Containerized seed orchard technology developed at Dorena for POC allows orchards to be updated as frequently as needed to increase genetic diversity or the amount and types of resistance.

Co-evolution of POC and PL. The genetic variability and evolutionary potential of the pathogen can also be important in developing resistance that would be durable. Fortunately, PL appears to have relatively little genetic variability (McWilliams 1999; Goheen et al. 2003). The geographic origin of PL is unknown, but is thought to be outside the range of POC (Goheen et al. 2003), and thus POC and PL have not co-evolved. The low genetic variability suggests the likelihood of a single or limited number of introductions. PL may or may not exhibit greater genetic variability in its sites of native origin. The chance of accidental importation of new strains of PL is very low, but could cause concern if strains with virulence to resistance in POC were introduced. However, the spread of such a strain should be slow, especially if any management measures that slow the spread of PL are in place. The lack of genetic variability in PL in the Pacific Northwest increases the likelihood of developing durable resistance. Pathogens with lower migration rates and relatively low population sizes are hypothesized to have relatively lower evolutionary potential (McDonald and Linde 2002). Thus there appears to be good likelihood for durability of complete resistance in POC. Even if breakdown of resistance were to occur in one location, the redistribution of any new virulent strain would be slow, if it would occur at all. An array of management techniques and options are available (Goheen et al. 2000) and can be utilized to increase the potential

Table 3&4-21.— Projected resistant seed availability per breeding zone by alternative durability of resistance for POC. Confirmed resistant parent trees in the field can be monitored over time to assay whether a new virulent strain of PL may have arisen.

In summary, the majority of trees in high hazard areas infested with PL would die. Without the use of resistant seedlings there would be little chance of large tree structure developing for POC in these areas. Some of these areas would continue to have large POC on nearby adjacent sites that are low hazard (particularly where POC is not confined primarily to riparian areas). Private landowners are unlikely to plant nonresistant POC decreasing the species diversity on their lands.

Utilization of Resistance

The current anticipated level of resistance to PL (50 to 75 percent survival) is high enough to deploy in those breeding zones for which there is orchard seed. The level and the number of resistant mechanisms should increase in the future. Resistant seed can now be used to achieve large POC on high hazard sites when this is a goal. Resistant seed can be used on almost any high hazard site for PL, except in areas where there is a high probability that infection would spread to uninfected POC downstream, or in sanitation areas along roads (because 25 to 50 percent of the seedlings from the first-generation orchards would be susceptible and that even the resistant seedlings may be host to PL spores [at a reduced level]). Planting guidelines for resistant POC should take account of the current expected levels of resistance.

Vegetative propagation (rooted cuttings for POC) may increase the survival to 75 to 100 percent, while still planting a diverse array of genotypes. However, this may not be the most cost-efficient because of (1) the added cost of rooted cuttings (over seedlings), (2) the potential added selection pressure on the pathogen (if relatively few clones are planted), and (3) the potential of increasing the resistance level available in the near future from seed.

Large amounts (millions) of resistant seed can easily be produced for those breeding zones for which there are containerized seed orchards. Direct seeding may be a viable alternative to planting in some cases.

The ease of seed production for POC also opens an opportunity to supply non-Federal landowners with seed for reforestation or horticultural needs. Estimates from 2000 indicate that the need from these landowners in coastal Oregon would be more than 400,000 seed per year. Without resistant seed, most non-Federal landowners would not plant POC (or would plant at much lower levels) and the forest plantations would be less diverse.

Effects of Alternatives — General Discussion

Port-Orford-Cedar Genetic Structure: The most critical variable for determining change in genetic structure of POC over the landscape may pertain to the percent of an area that is of high risk to the disease, and the respective probabilities for infection and associated mortality over time. This percentage would vary over the next 100 year period of time, depending upon the selected management alternative, over portions of the POC range accordingly: Coos Bay BLM District/Siskiyou NF Powers Ranger District—16 percent to 19 percent; Siskiyou area—15 percent to 34 percent; and Inland Medford and Roseburg BLM—19 percent to 50 percent (Table 3&4-10). On the basis of the affected areas where mortality might progress/

occur and the fact that subpopulations would infrequently be (if ever) entirely extirpated in the POC range, the very localized genetic population structure(s) would be impacted to varying degrees, but the species' genetic structure, overall, should not be intrinsically altered. This is due to the large number of natural regeneration, proximity of neighboring subpopulations or stands, and migration events (gene flow) that occur over time. In addition, the degree to which resistant stock is reintroduced into the infected locales would also be a factor in the effects per alternative. The basic causal factors associated with changes in population structure apply to the planted stands as well. Gene exchange continues amongst the neighboring subpopulations, and the genetic structure evolves for the same reasons as stated previously.

Availability of Resistant Seed for Restoration: Although POC is not in danger of extinction, there are some high hazard areas (particularly riparian areas) where 90 percent or more of the POC trees are dead. In these PL infested areas it is not likely that POC would get older and bigger as long as the disease is present and there is no resistant stock planted. If large POC trees in these specific areas are desired, the use of restoration with resistant seedlings may be effective. Restoration, either following PL infestation and mortality, or preemptive (on sites anticipated to suffer high mortality in the next 50 or 100 years) would potentially allow for reestablishment of POC as it existed before PL. The use of standard silvicultural tools may be used to promote good growth of POC, thus decreasing the time to develop large POC trees.

Once resistant trees are established in heavily impacted areas they would serve as parents for future generations, thus allowing for natural regeneration. This would be particularly desirable if there are affected portions of Late-Successional Reserves where large POC is desirable for future generations. In most areas, the genetic base for future generations would be large and would include both surviving POC around the infested riparian area and the resistant POC. Thus, the genetic composition for the future would continue to be broad and help ensure adaptability of POC to changing future environments.

In fall 2002, large quantities of resistant seed became available for 3 of the 19 breeding zones that include Oregon (some of these zones also include parts of California). Seed from one of these breeding zones could probably be used for two others without much compromise in either resistance or adaptability. Thus, the option of restoration with resistant seed is now available to land managers, particularly in the coastal Oregon Breeding Block 1 (Table 3&4-21). Under current program levels, it is projected that resistant seed would be available in 2010 to 2045 for other breeding zones (Table 3&4-21)

Since POC readily produces abundant seed, resistant seed could be made available to non-Federal landowners, although some barriers to this seed transfer need to be overcome. Use of resistant POC by non-Federal landowners would provide these landowners with another species to use in their plantings, adding to the biodiversity on the landscape and potentially boosting local economies. This is also important in these areas because of the recent negative impacts of Swiss Needle Cast disease of Douglas-fir as well as the potential impacts of Sudden Oak Death to the diversity of the forests and plantations (POC is thought not to be susceptible to either of the causative pathogens). Management of the seed resource by the BLM and FS would help ensure genetically diverse seed would be used—this should help ensure durability of resistance by limiting the potential for plantations involving only one or a few clones. Guidelines could be developed to help all landowners play a role in maintaining the durability and utility of the resistant POC resource.

For breeding zones without enough tested selections to find resistant parents to utilize for seed production there are several options, including:

1) No mitigation of high hazard PL infested areas with POC mortality now or in the future. Leaving the process to strictly natural regeneration when only a few rare scattered resistant POC serve as the foundation for future regeneration may severely restrict genetic diversity. Large trees (if they do develop in each local area) would be very limited in their genetic variability (probably be the offspring of only a couple resistant trees even if pollen were to come from additional susceptible trees).

2) No mitigation of high hazard areas now due to lack of resistant seed, but proceed with the development of resistant orchards to allow restoration efforts at a future date (2010 to 2045 depending upon breeding zone). The restoration of large POC in the ecosystem would be delayed, but the genetic diversity would be broader when they are established. This would provide for a POC population more likely to persist over generations.

Breeding zones vary dramatically by the acreage of POC on Federal lands (see Table 3&4-21). However, the breeding zones where resistant seed would be most valuable for restoration may depend other factors, including the role POC plays in the specific ecosystem, the percentage of POC on high-risk sites, and the relative abundance of POC in a area. Prioritization of breeding zones by managers would potentially enable earlier resistant seed development in the zones given higher priority. New selections could generally have a resistance evaluation and be producing seed in as little as 5 years of selection in the field—timing of orchard seed availability depends upon level of funding available, and to a lesser extent, limits of facilities and personnel.

Effects of Alternatives — Discussion by Alternative

Alternative 1

Port-Orford-Cedar Genetics Structure: The relative projection of infection/mortality (Table 3&4-10) varies between 17 to 29 percent over the extent of the species' range in Oregon. The relative mortality predictions are similar for Alternatives 1, 2, and 3 within each of the respective macrogeographic areas; defined as Coos Bay BLM District/Siskiyou NF Powers Ranger District, Siskiyou, and Inland (Medford and Roseburg BLM). Fragmentation would likely be higher in the Inland riparian zones as opposed to the other two macrogeographic areas. However, there would still be survivors within the immediate infested area (about 10 percent), and neighboring uninfected POC (seed trees) reside within the confines of riparian vegetative habitat (outside of, or on microsites within, the highly infected zone). This allows both natural regeneration and pollen flow throughout the area. Thus, there is likely to be little effect on genetic diversity and structure over the landscape scale. Gene frequencies have been and would be modified to an extent, but this also occurs in the natural populations (uninfected) as well. The Coos Bay BLM District/Siskiyou NF Powers Ranger District area has larger continuous stands and subpopulations. This area would experience large amounts of natural regeneration from a larger gene pool base in addition to larger gene flow (pollen). This should create less population level divergence, and should also promote population structure stability over time.

Resistant stock would also be planted in varying amounts in infected areas, and this would help conserve the gene pool and structure to a commensurate degree. The planting of resistant stock in those breeding zones with orchard production should enhance genetic diversity in comparison to those breeding zones without. This is a result of the relative difference in gene frequencies (in this seed orchard population versus local stand population), which creates a more diverse genetic base in this locale after planting.

Availability of Resistant Seed for Restoration: Under Alternative 1, the interagency resistance program would proceed at current levels (assumes funding is stable). No resistant seed was available until fall 2002 (for some breeding zones), but restoration with resistant seedlings can now be considered in project analyses and used as a mitigation technique where relevant.

Seed orchards have been established for a few breeding zones, but for most breeding zones many more field selections (probably more than 1,250 per breeding zone) are needed to find the low frequency resistant trees.

The source and timing of funding for additional field selections would determine which other breeding zones resistant orchards are developed as well as the timeline to develop them. Table 3&4-21 projects by breeding zone when resistant seed might become available. In order to increase the diversity of resistance and level of resistance, breeding would need to continue after the initial first generation orchards were established.

For planting on low hazard sites, nonresistant or resistant seedlings could be utilized. Under this alternative, restoration on high hazard sites could begin now for only certain breeding zones; other breeding zones would not have resistant seed for another 7 to 42 years (Table 3&4-21). Without this restoration effort, large POC would likely not develop in many affected areas.

Alternative 2

Port-Orford-Cedar Genetics Structure: The relative projection of infection/mortality (Table 3&4-10, Pathology section) varies between 17 to 27 percent over the extent of the species' range in Oregon. This is virtually the same as Alternative 1 projections, and for the reasons described in Alternative 1, there is probably little effect on genetic diversity and structure over the landscape scale. One minor difference pertains to the slightly decreased infection rates, with obvious, commensurate declines in need for restoration plantings.

Availability of Resistant Seed for Restoration: Alternative 2 would be similar to Alternative 1 (see above) in potential effects of resistant seed. One of the objectives of this alternative is to attempt to reestablish POC in plant communities where it has been significantly reduced in numbers by root disease. Restoration with resistant seed would be the best opportunity to accomplish this. As in Alternative 1, the continued development of resistant stock for various breeding zones would continue at current levels (assuming current funding levels maintained). A deployment strategy for the planting of resistant POC stock would be included, and would give consideration to state, county, and private lands (see Appendix 6). Because a seed bank for each breeding zone that has an orchard for the production of resistant seed would be established, there would be seed available immediately after stand replacement events such as large-scale wildfires.

Alternative 3

Port-Orford-Cedar Genetics Structure: The relative projection of infection/mortality (Table 3&4-10) is 15 to 19 percent over the extent of the species' range in Oregon. In Alternative 3, the change in genetic structure and diversity outside of the POC core areas should be similar to effects stated in Alternatives 1 and 2. Protecting uninfested POC cores and buffers (6th field watersheds map for Alternative 3), if successful in preventing infection by PL over a longer period of time, would maintain the populations in a more natural state. The population structure would be affected less in these areas, where they evolve without the PL factor being present.

Availability of Resistant Seed for Restoration: The use of resistant seed and its effects (increasing the potential of large POC trees in high hazard areas infested with PL in the future) should be similar to Alternatives 1 and 2. Because of the additional protected areas, there should be fewer PL infested areas that may need restoration with resistant seedlings.

Alternative 4

Port-Orford-Cedar Genetics Structure: The greatest amount of infection and predicted mortality occurs in Alternatives 4 and 5 (Table 3&4-10): Coos Bay BLM District/Siskiyou NF Powers Ranger District—19 percent; Siskiyou—34 percent; and Inland—50 percent. The effect of this alternative in the Coos Bay BLM District/Siskiyou NF Powers Ranger District area would be similar to those stated in Alternatives 1 and 2. Population structure would not change to a great extent in this area, with or without the planting of resistant stock, in consideration of the large amount of natural regeneration, gradual environmental gradients, and more continuous interbreeding populations. The largest amount of fragmentation and effect on population structure would occur in the Siskiyou and Inland populations. The planting of resistant stock provided in this alternative would be helpful in conserving and/or improving upon the diversity of gene pools. The accelerated level of resistance breeding provided in this alternative, should enable resistant stock to be planted at a quicker rate across more breeding zones, if so desired. Large planting programs in the inland breeding zones would also modify the populations to a greater extent than that described for the Coos Bay/Powers area. Initially, effective population sizes would probably decrease (in numerical number) even more in the Inland zones because of high-risk sites (scattered riparian habitats) being spread (with resultant fragmentation) across the landscape. Selection pressures over the expanded area would change allele frequencies to some extent, and is expected whenever selection pressures are applied to populations. Planting resistant stock in these situations may have the greatest relative genetic benefit (see discussion on migration of genes in Effects on Genetic Structure section). However, the effective population sizes (within and among subpopulations) should still be within the orders of magnitude that are sufficient to prevent large scale population divergence and loss of common alleles across the landscape.

Availability of Resistant Seed for Restoration: Alternative 4 would expedite the availability of resistance seed for those priority breeding zones in which seed is not available (Table 3&4-21). More high hazard areas would be expected to experience mortality under Alternative 4 (78,000 acres compared to 43,000 acres under Alternative 3, and 52,000 acres under Alternative 2); more resistant seed would be needed to replace dead POC (however, seed availability is not anticipated to be a limiting factor, once an orchard is operational for a given breeding zone). There are still many areas in all parts of the range of POC that are low risk. In the future as resistant trees develop, this alternative should lead to an increase in large POC over the landscape in those high hazard areas that would be PL infested under other alternatives. The sooner the resistant seed is developed the sooner the restoration of large POC can develop. However, additional restoration would be needed in areas that would not be affected under Alternatives 1, 2, and 3.

Alternative 5

Port-Orford-Cedar Genetics Structure: The predicted levels of mortality are the same as in Alternative 4, but resistant stock would be limited primarily to the Coos Bay BLM District/ Siskiyou NF Powers Ranger District area (about 65 percent of the POC acreage). Population structure would not change to a great extent in this area for the reasons described in Alternative 4. The changes in population structure and probable changes in the gene pool would be slightly greater in this alternative versus Alternative 4. This is due to the inability to plant resistant stock into the Siskiyou and Inland areas. The effects of this alternative would be similar to Alternative 4, except that there would be minimal opportunities for restoring the impacted habitats. While natural evolution of resistance to PL is theoretically probable, the rate and degree of natural resistance would vary markedly over time and space. Selection pressures in this alternative would have similar effects as in Alternative 4, where allele frequency change over time reflects the high selection pressures within the infected areas. Failure to plant resistant POC in the Inland breeding zones of highest disease incidence can lead to lesser effective population numbers in localized areas (where disease is present). This could lead to greater population divergence and loss of rare alleles. However, the effect on the overall population structure across the landscape should still be similar in magnitude to Alternative 4, where there is sufficient variation across the landscape in effective population sizes to prevent large scale population divergence and loss of common alleles.

Availability of Resistant Seed for Restoration: Under Alternative 5, only some breeding zones would have resistant seed available (only those for which orchards are currently available) (see Table 3&4-21). For most breeding zones, 85 percent of high hazard areas for PL would seldom achieve large POC, resulting in a loss of large POC across the landscape (in high hazard areas which include many riparian areas). Further development of resistant program would cease, limiting the diversity of parents represented in current orchards as well as the potential for including other resistance mechanisms. Impacts could be reduction in potential durability of resistance to PL, as well as continued absence of large POC in some areas. Under this alternative there would the most acres affected (similar to Alternative 4) and the fewest acres with restoration using resistant seed (few breeding zones would have seed available), resulting in the fewest acres potentially achieving large POC.

Fire and Fuels

There are three aspects of Fire/Fuels potentially affected by POC root disease and the alternatives for its management: (1) the management requirements of the various alternatives can have a direct affect on the Agencies' ability to fight fire successfully; (2) the direction in the various alternatives can have a direct affect on the Agencies' ability to reduce forest fuels; and (3) the level of fuel loading created by disease-killed POC. Since POC killed by the root disease contribute directly to forest fuel loading, the success of the alternatives at reducing mortality affects forest fuel-loading levels. Mortality-related fuel-loading differences between the alternatives is much less than 1 percent of the total fuels in the area at any one time because of the distribution and stocking levels of POC in the landscape, the relatively slow spread of the disease, and the relatively limited difference in annual POC mortality between the alternatives. Hence, this third aspect will not be discussed further in this section.

Affected Environment

Wildland Fire Suppression

Wildfires are common within the range of POC. Southwestern Oregon has a long history of major fire occurrence (Payne 1983; Haefner 1975; Cooper 1939; Morris 1934). Recent large fires have included the 500,000-acre Biscuit Fire in 2002, the 6,998-acre Mendenhall Fire in 1994, the 2,201-acre Chrome Fire in 1990, and the 9,860-acre Longwood Fire and 96,310-acre Silver Fire in 1987.

Fire occurrence has averaged 35 fires per year on the Siskiyou NF (1970 to 2003), and 34 fires per year on BLM-administered lands (1970 to 2002). A majority of these wildfires (71 percent) are suppressed at less than 0.25 acres. A little over 1 percent of the wildfires exceeded 100 acres. Most of the wildfires are lightning caused (52 percent), as are nearly all of the large fires (greater than 1,000 acres) (79 percent). The next most common cause of all wildfires (22 percent) is from recreational users (such as campfires and smoking). Fire season is typically during the drier months with approximately 86 percent of all fires occurring from June 1 through September 30. Fires are generally less frequent from east to west and south to north in the range of POC. The Powers Ranger District, for example, has the greatest concentration of POC in the world, but averages less than three wildfires per year (1970 to 2003) with the largest fire at 94 acres.

The objectives of initial attack fire suppression is to safely and efficiently suppress fires in conformance with existing policy and procedures, consistent with approved fire management and land and resource management plans. The FS has initial attack responsibility for the Siskiyou NF and the BLM has contracted with the Oregon Department of Forestry for its initial attack fire suppression.

All wildland fire suppression Agencies in southwest Oregon have interagency agreements to share suppression resources within preplanned responsibility areas. These areas generally border adjacent Agency jurisdictions, and several Agencies could respond to a wildfire in these mutual aid areas. Resources dispatched to a wildland fire depend on the Agency jurisdiction, values threatened, preplanned dispatch plans, fire danger rating for the day, and resource availability.

All of the wildland fire Agencies rely on similar initial attack fire suppression resources, such as engines, hand crews, tractors, aircraft (including fixed-wing air tankers and helicopters), smoke jumpers and rappellers. The staffing and availability of these resources are determined by the time of year, available funding, seasonal severity, and minimum fire organization. Engines are typically the primary initial attack resource in areas with road access. The use of water can quickly facilitate containment, control, and mop-up of a wildfire. Hand crews, tractors, and aircraft (helicopters or air tankers) may also be part of the preplanned dispatch or ordered if necessary by the incident commander. Where road access is poor, crews may have to walk long distances to reach a fire. In these cases, aircraft are often used to mobilize hand crews, rappellers, or smoke jumpers. Firefighters in remote locations also utilize portable pumps to access water from sources close to a fire.

Fixed-wing air tankers may deliver fire retardant and helicopters may provide water bucket drops to knock down rapidly initiating fires regardless of ground access. The helicopter buckets are filled from streams, rivers, lakes, or ponds close to the fire that are large enough for the bucket and safe to access by the helicopter. The primary initial attack fire suppression helicopter is a shared-resource, rappel-capable, light helicopter (130 gallons of water per bucket) based in Merlin. The Oregon Department of Forestry also staffs medium helicopters (300 to 700 gallons per bucket) for 60 days at the peak of the fire season in Central Point and Roseburg. In severe fire seasons, a heavy helicopter (1,500 gallons per bucket) has occasionally been staged for initial attack.

A wildfire that escapes initial attack enters extended attack or the transition phase to a large fire operation. These fires become increasingly complex and large with many resources, logistics needs, and safety concerns. Only a small percentage of all fires enter this phase, but they require the most resources, and aircraft, and affect the largest number of acres.

Firefighter and public safety is the first priority in every fire management activity (USDI and USDA 1998). If there is risk to firefighter or public safety, the incident commander would safely and efficiently take appropriate suppression action with available resources without any POC considerations. Equipment could be ordered and used as soon as it was available on the fire, and water could be used from any source.

POC Management Practices become a concern to fire managers when there is POC near the fire and especially when it is known to be uninfected. Some POC management practices are not a concern during initial attack operations. Initial attack fire suppression resources, such as engines and crew vehicles, are normally clean and washed on a daily basis, and water in the fire engines is usually from uninfested sources. The fire season is also during the dry season and the warmer times of the year when the risk of spreading POC root disease is the lowest.

Management practices start to effect wildfire suppression when additional water is needed on a fire (such as refill engines, pumping from local sources, and helicopter bucket drops) and/or resources accessing the fire are going through both clean and infested areas. Management practices to reduce the risk of spread of PL decrease the efficiency of fire suppression resources and increase the costs of operation. The greatest effect would be on a fire with uninfected POC where the closest available water source is infested. Application of Clorox (see Appendix 4) in engines or water tenders would be relatively inexpensive and not lose much time. Planning for and installing a pumping station to treat water before pumping it to the fire would require time and additional personnel (if it was feasible). If a helicopter would have to travel 5 minutes longer to a clean source for bucket use it would reduce the number of bucket drops in a day. Helicopter water operations usually attempt to keep the turn time for a bucket load to less than 15 minutes. If the infested source was a 10-minute turn and the clean one was 15 minutes, the effect is a 33 percent reduction in the number of buckets the helicopter can deliver in an hour.

The recent Biscuit Fire (2002) is an example of how POC management practices can affect wildfire suppression. Five lightning fires that started in the Kalmiopsis Wilderness and adjacent roadless areas burned together over several months into the 500,000 acre fire

(USDA 2002). These remote fire starts were initially a low priority for suppression resources when many other fires in southwest Oregon and the region were threatening communities. The size of this fire resulted from concerns for firefighter safety, early resource unavailability, poor road access, fire weather conditions, protecting structures and communities at risk, and using available roads and topographic features for control lines. POC management practices probably did not affect the size of this fire, but did affect the cost.

The drainages around the initial fire starts were known to be uninfested and have populations of POC. Management practices in place early on included ensuring contract equipment were clean and inspected before going to the fireline, and locating clean water sources for the few aircraft available. As the fire grew increasingly larger and more complex, the POC mitigations also increased in scale and complexity. None of the mitigations affected firefighter or public safety or property. There were up to four incident management teams at one time on this fire, with thousands of firefighters, hundreds of pieces of equipment, multiple fire camps, incident command posts, and hundreds of miles of fireline and access roads. Management practices for protecting POC included: identification of travel access routes, multiple wash stations, identification and mapping of approved water sources for helicopter and ground resources, and installation of helicopter dip tanks to supply treated water closer to the fire. Wash stations were also installed at the fire camps, spike camps, and equipment staging areas. Many of these stations were staffed 24 hours a day for several months with a minimum of two persons, a water tender, and an engine. All vehicles were washed at least once a shift and sometimes several times depending on their assignment and travel route. If equipment was moved between Divisions on the fire, it was also washed if it was going from an infested area to a clean one. All of these management practices increased the number of personnel on the fire, increased the amount of equipment, increased the time personnel spent washing vehicles or following longer travel routes, reduced the efficiency of helicopter and ground resource water use, and required planning to implement. It is estimated these practices added between $1.5 million and $3 million to the suppression costs of $150 million, or about 1 to 2 percent to the total cost. On smaller fires, the percentage could be higher.

Each wildfire situation is different and it is impossible to estimate the cost of POC management practices over the entire southwest Oregon area. It should be assumed that implementation of POC management practices would not affect firefighter or public safety or private property, but could increase the acreage burned, damage to natural resources, and cost of suppression for wildfires that escape initial attack where POC is found. Severe wildfires can kill POC. Larger fires in the range of POC would result in the loss of more POC to wildfire mortality. Small fires on average have lower total fire suppression costs than large fires, but have far higher per acre costs. Siskiyou NF average costs per acre (1990 to 1999) for fires less than 1 acre is $4,740, and for fires 5,000 to 10,000 acres is $373. The cost of the Biscuit Fire (the most expensive wildfire to suppress in history) was approximately $300 per acre. Additional aircraft time on a small fire could easily double the suppression costs.

Fuels Management

The 1995 “Federal Wildland Fire Management Policy” (USDA and USDI 1995) directs Federal land management Agencies to achieve a balance between fire suppression and fuels management to sustain healthy ecosystems. While previous policies emphasized fire suppression, the current policies emphasize fuels management as a part of ecosystem management (USDA and USDI 1999, 2000, and 2001). This approach recognizes fire as part of the ecosystem, and focuses on hazardous fuels reduction, integrated vegetation management, and firefighting strategies (USDA and USDI 2001). The "Healthy Forests Initiative" (2002) also emphasizes more active forest and rangeland management to reduce the accumulation of fuels and to restore ecosystem health. Attainment of the goals of the 10-year Comprehensive Strategy requires an investment. Market-based approaches (selling by-products) to offset the cost of hazardous fuels reduction are encouraged wherever feasible and cost effective (USDA and USDI 2001).

Hazardous fuels treatments should be designed to:

- Reduce the risk of wildand fire to communities and the environment;
- provide safety to firefighters; and
- improve ecosystem health.

The focus is on actively managing acres in the wildland-urban interface, and acres outside of the wildland-urban interface that are in Condition Classes II or III (have missed two or more natural fire cycles) to reduce hazardous fuels and restore fire-adapted ecosystems (USDA and USDI 2003).

The wildland/urban interface is defined as the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuel (USDA and USDI 2001). Communities at risk within the range of POC and near Federal lands include Agness, Cave Junction, Grants Pass, O'Brien, Powers, Selma, Williams, and Wolf Creek. These communities include surrounding developed areas outside of the defined city limits. The BLM has the largest percentage of Federal lands in the interface in southwest Oregon. The highest priority treatment areas are generally on the eastern and southern Oregon portions of the range of POC.

Condition class is the degree of departure from historical natural fire regime resulting in changes to key ecosystem components, such as stand structure, age, and degree of canopy closure. Due to fire exclusion policies, grazing, invasive plant species, and insects and disease (1995 "Southwestern Oregon Late-Successional Reserve Assessment") many areas in southwest Oregon are in Condition Class II or III. Fire frequencies have been altered and there is an increase in fire size, frequency, intensity, severity, or landscape pattern. The risk of losing key ecosystem components is also moderate to high. The recent Biscuit Fire is such an example (USDA 2003). Large areas of Late-Successional Reserves, Riparian Reserves, and uninfested POC were burned. Over $150 million was also spent to suppress this fire and protect adjacent communities.

Federal Agencies in southwest Oregon have actively managed hazardous fuels on Federal lands for many years. Treatments were historically linked to timber sale activities, but are becoming more associated with treatment of natural fuels in the wildland-urban interface. These are the priority areas for hazardous fuels treatment to reduce wildland fire risks to communities and allow wildfire to take a more natural role in the surrounding forest. The Medford BLM District and the Siskiyou NF currently treat the most acres of the administrative units in the planning area. Over the next 5 years, the Grants Pass BLM Resource Area could accomplish 70,000 acres, the Glendale BLM Resource Area 4,200 acres, and the Siskiyou NF 23,000 acres. Most of these treatments are not in stands with POC. The actual acreage treated is highly dependent on funding and is lower than the numbers indicate, because many of these treatments are accomplished on the same acre.

Hazardous fuels treatment objectives are to change fire behavior by reducing its rate of spread or intensity, or to maintain conditions that support desirable fire behavior characteristics. Combinations of treatments are used in southwest Oregon to restore vegetation and historic fire conditions. Most of these treatments are noncommercial, but integrated vegetation management with commercial timber harvesting or producing by-products also occurs. In the high hazard areas next to communities, pretreatment is often needed prior to any prescribed fire use. This is because most areas are well outside the natural fire regime and fire cannot be reintroduced without first modifying the fuels in some way (pretreatment). Dense understory vegetation from years of fire exclusion has resulted in ladder fuels that contribute to crown fire initiation and excess down woody fuels have accumulated. Pretreatments include: the cutting, hand piling, and hand pile burning of excess vegetation and fuels; mechanical treatments to masticate or crush fuels and vegetation; and small diameter tree removal for by-products. The usual plan is to underburn within a few years of the pretreatment to reduce vegetation regrowth and maintain desirable fire behavior characteristics.

Hazardous fuels reduction and integrated vegetation management is a potentially large and recurring program in the range of POC (tens of thousands of acres per year). The majority of acres needing treatment would not have POC in the stands, but about 17 percent of the planning area contains stands with POC as a component. Drainages could have POC populations, and access roads could traverse areas with POC. POC management practices could affect wet season (October 1 through May 31) operations, road access, water use, and available treatment options. This in turn would affect the timely implementation, cost, and accomplishment of fuel treatment activities.

Many of these fuel treatments are labor-intensive mechanical or manual treatments. Workers may walk over nearly the entire stand at several different times to cut vegetation with chain saws, lop and scatter slash, hand pile slash, and burn hand piles. Daily production rates are low and large crews and/or a long season is required to accomplish the amount of work. Walk-ins to the work site reduce crew production rates. Mechanical treatments that masticate or crush vegetation have higher production rates, but require access for the machinery and operators, and maintenance and refueling on a daily basis. Seasonal restrictions or road closures limit the amount of time a contractor can work or restrict access. Work in summer is often affected by seasonal industrial fire precaution level restrictions due to fire season severity. Even in the dry season contractors may not be allowed to run saws or motorized equipment.

Road access affects treatment options, access to work areas, travel time to work areas, and access to water sources. Treatments such as small diameter tree removal and commercial timber harvest require a well-developed road network to be feasible or economically viable. Crews also need some road access to accomplish hand treatments and prescribed burning. Long walk-ins increase costs and risks with prescribed burning, and reduce the feasibility of treatments.

Prescribed fire uses, such as hand pile burning or underburning, are normally accomplished during the wet season to meet burning prescription objectives and reduce fire escape risk. Hand crews and engines usually accomplish the burning. Equipment is washed and cleaned on a daily basis, and water in the engines is from uninfested sources. Unlike wildland fire suppression, prescribed fires are preplanned and have a project-specific burn plan. Where POC is a concern, the burn plan specifies mitigation measures that could include: priority of operations, travel routes, water sources that require treatment with Clorox, or additional washing.

The costs of hazardous fuels treatments and the number of acres accomplished are interrelated. High per acre treatment costs result in fewer acres being treated due to funding limitations.

Effects of the Alternatives

Alternative 1

Wildland Fire Suppression: POC management practices have the greatest potential effects on fires where there is no immediate threat to firefighter safety, public safety, or private property, and the fire is either not controlled during initial attack by ground-based resources or requires local water use by crews (portable pumps) or helicopter water drops. Larger fires require equipment inspections, travel access management, wash stations, identification of clean water sources, setting up helicopter dip tanks to treat water closer to the fire, and greater use of water tenders. When additional water is needed by engines and water tenders, Clorox is available to treat unknown or infested water sources in the field. To the extent these actions delay suppression action or decrease the efficiency or fire suppression resources, the potential size, cost per acre, and total cost of a fire could be increased.

Approximately 20 percent of all fires on NF lands and 30 percent of all fires on BLM lands receive helicopter water bucket drops. Assuming safety and property are not threatened, delays can occur if POC status and clean water sources are not already known and identified. For example, if there were uninfested POC in the fire area, helicopter water drops would be from the closest clean water source. It could require additional time to find and verify a clean water source. If the clean water source is farther away than an infested source, then the potential efficiency of the helicopter has also been reduced and there could be both a larger fire size and an increased cost per acre. The increased cost is the flight time to deliver the water needed on the fire. One solution when resources are available is to add extra or larger aircraft ($600 to $900 per hour for a light and $1,200 to $1,800 per hour for a medium) to make up for the difference in lost efficiency if multiple water drops are needed. Another is to utilize an air tanker with retardant (approximately $5,000 per load) to hold the fire until other resources can get to the fire. If resources are unavailable or additional time is necessary to acquire them, then the fire could get larger. The use of these additional resources could easily double the cost of a relatively small fire. All of these activities increase the complexity, number of resources, and cost of an incident.

If management results in larger fires, it increases the areas at risk to PL spread from suppression actions, and can result in the loss of more cedar to fire mortality.

Fuels Management: POC management policies would affect wet season operations. If uninfected POC is within the work area or accessed by roads with seasonal restrictions, activities could be restricted to the dry season. This would contribute to scheduling difficulties to accomplish the work, require hiring more seasonal workers, and provide a less stable local work base. It could also make the purchase and use of specialized small-diameter tree removal or masticating equipment uneconomic by local contractors if it cannot be used for a large part of the year. This would increase the cost and time to accomplish the work, and limit the available treatment options. Mitigations such as daily washing of vehicles and tools, scraping mud off of boots, and priority of operations also have a minor affect on the cost. Prescribed fire burn plans would also include restrictions or mitigation measures that reduce the burning window or increase costs through required mitigation measures.

In general, the larger the potential hazardous fuel treatment program in areas with POC concerns the greater the effect would be on accomplishing the work and the potential for increased costs. Although cost increases may only be in the order of 5 percent to 10 percent for planning, implementation, and monitoring, some areas would probably not be treated due to the difficulty of scheduling treatments around seasonal restrictions or road closures (primarily for prescribed burning). Higher per acre costs would also reduce the total number of acres treated.

Alternative 2

Wildland Fire Suppression: This alternative is similar to Alternative 1, but would be simpler to implement the management practices due to more consistent policy over multiple-agency jurisdictions. Some preplanning would be in place, and the risk key would facilitate quicker decisions by incident commanders and resource advisors in the field. This would reduce potential delays in planning and implementing fire suppression tactics and operations, and slightly reduce the potential acreage and costs of a wildfire compared to Alternative 1.

Fuels Management: This alternative is similar to Alternative 1, but it would be simpler to implement the management practices due to consistent policy, and the risk key would facilitate easier identification of POC areas that do not require management practices. Unlike wildfire suppression, fuels management activities are preplanned and POC management practices are integrated into those plans. This would be expected to slightly reduce the cost per acre of fuel treatments and increase the acreage treated compared to Alternative 1.

Alternative 3

Wildland Fire Suppression: This alternative could have the greatest potential effect on fire suppression. Reducing road density in POC buffers and cores would limit access for resources such as engines and hand crews. This could increase the time it takes to respond to a wildfire and lead to larger fires. It could also require the use of more resources and water than if better access allowed prompt and successful initial attack. Many of these POC buffers and cores are adjacent to private property and communities. Additional restrictions on water use within the POC cores and buffers could also reduce helicopter efficiency and could increase fire suppression costs in extended attack or large fire operations. POC management practices may have to be foregone in these areas if fire threatens nearby property.

This alternative could contribute to larger fire size and higher suppression costs than the other alternatives. It would slightly increase the risk of POC fire mortality in the POC cores and buffers due to less efficient initial attack and larger fire size.

Fuels Management: This alternative would have the greatest potential effect on fuels management in the wildland-urban interface. Many of the proposed POC cores and buffer areas are adjacent to or include high priority for treatment wildland-urban interface areas. Approximately 2,300 core and 60,000 buffer acres are within the wildland-urban interface. Reducing road density or increasing seasonal road closures in POC buffers and cores would limit access for fuel treatment projects and prescribed burning crews and resources. Treatment options may not be feasible or costs would be increased. The result would be the least amount of acres treated because of higher costs, or result in not treating the POC buffers and cores and treating less expensive acres elsewhere. The latter could result in larger and more severe wildfires in POC cores and buffers as well as threaten communities.

Alternative 4 and 5

Wildland Fire Suppression: These alternatives would have the same effect on wildfire suppression. Resources could be used without any considerations for POC root disease. No restrictions on water use or requirements for Clorox would maintain the effectiveness of helicopter bucket drops and other water use operations. Fire suppression costs and, potentially, final fire size would be the least of all of the alternatives. This would primarily benefit those few wildfires that escape initial attack, are in extended attack or large fire operations, and are in areas with uninfested POC.

Fuels Management: These two alternatives would have the least effect on fuels management. Hazardous fuels treatment projects could be implemented without any considerations for POC root disease. No restrictions on water use or requirements for Clorox would maintain the effectiveness of water use operations during prescribed burning operations. Road access would be available to cheaply implement projects and utilize the full mix of fuel treatment options to accomplish the most acres of treatment.

Air Quality

Affected Environment

The Federal "Clean Air Act," as amended in 1990, is designed to reduce air pollution, protect human health, and preserve the Nation's air resources. To protect air quality, the Act requires Federal agencies to comply with all Federal, state, and local air pollution requirements (Section 118).

Effects of the Alternatives

The effects of the alternatives on air quality is unquantifiable and inconsequential. The degree to which Alternatives 1, 2, or 3 might increase wildfire size because of increased POC mitigation measures is offset by the reduction in overall mortality which would slightly decrease fuel loading and soil erosion that could lead to wind-borne soil.

Recreation, Visual, Wilderness, and Wild and Scenic Rivers

Affected Environment

Recreation within the analysis area ranges broadly, from relatively unstructured and dispersed recreation use, to structured, activity-based recreation within managed areas, sites, roads, or trails. Total recreation use on public lands within the analysis area is approximately 2.5 million visitor use days.

The analysis area has a number of developed campgrounds, lakes, rivers, and trails (such as horse, foot, and motorized) on public lands where recreation use (47 percent) is managed (USDI-BLM 1995b, p. 3-84). Managed sites in the area operate near capacity during the high use months of June through September.

Segments of the Rogue, Illinois, Chetco, and Umpqua Rivers are congressionally designated components of the National Wild and Scenic Rivers System; other streams are in various stages of study and evaluation for inclusion within the system. These river reaches provide over 1 million visitors per year with whitewater rafting opportunities.

There are numerous wilderness areas (such as the Kalmiopsis and Wild Rogue Wilderness Areas) throughout the region, and a few wilderness study areas. These areas provide unconfined primitive recreation opportunities for hikers and horseback riders. Both wilderness and wilderness study areas share the same management objective of allowing natural processes to predominate, and mechanized activity is not allowed. These areas do allow horseback riding, pack stock, and some livestock grazing.

Dispersed recreation consists of back-country camping, hiking, horseback riding, picnicking, general sightseeing, driving for pleasure, hunting, fishing, whitewater rafting, winter sports, and off-highway vehicle use. These uses account for about 20 percent of total use throughout the analysis area, and are typically by those desiring an uncontrolled environment, unaffected by other users (as occurs in managed sites).

Dispersed recreation activities, which are affected by level of access, are most likely to be affected by general land use management standards and guidelines, due to the unstructured nature of the activities and their prevalence on all public lands.

There are no existing demand analyses for dispersed recreation opportunities within the analysis area. Off-highway vehicle industry leaders predict, however, that off-highway vehicle use has, and continues to, rise dramatically within the State.

Off-highway vehicle management guidelines vary slightly between the different land management agencies; however, they all basically contain the same tenets of protection of natural resources, providing for visitor safety, and minimizing conflicts among various users (USDI-BLM 1995).

Depending on the resource conditions and characteristics within different drainages or areas, lands are generally classified as open, closed, or limited, to off-highway vehicle use. Open is defined as an area where all types of vehicle use is permitted at all times, anywhere in the area subject to applicable operating regulations and vehicle standards. Closed is simply defined as an area where any off-highway vehicle use is prohibited. Limited means an area is restricted at certain times, in certain areas, and/or to certain vehicular use (43 CFR, 8340.0-5, 2002).

These off-highway vehicle use classifications are periodically reviewed as part of each Agencies' land management planning process and are adjusted/changed as needed to respond to changing resource conditions, use patterns, and public input expressing a demand for recreation opportunities.

The Agencies also include off-highway vehicle use, horseback riding, hiking, mountain biking, and any other mode of transport in the construct of specific transportation management plans. Such plans are usually part of or adjunct to the broader land management plan governing that particular administrative unit, and address broad issues concerning access to public lands.

The visual resource within the analysis area has been inventoried and has received scenery quality ratings based upon an analysis of a particular viewshed's uniqueness within the region, its relative importance as a component of the characteristic landscape when viewed from popular observation points (Interstate highways, view points, points along rivers and trails) and other factors. Generally, the scenery quality within the area is considered high by most visitors based upon the prevalence of extensive conifer stands, interesting physiographic features, and opportunities for viewing. Although POC seldom occurs in pure stands, its dense, green foliage makes a significant scenic and esthetic contribution to the forests. Its affinity for water particularly brings it into contact with many forest users, such as at campgrounds and other high-use areas. Recreation activities that may be linked with the occurrence of POC include camping in sites dominated by a POC overstory and photography.

The overall character and perceived quality of the visual resource varies by location, viewer, and type of use. Qualitative statements regarding scenic quality are dependent on a variety of factors. It can be assumed, however, that the color contrasts presented by browning POC crown(s) amidst a stand of healthy trees would create a color contrast at that site. Higher mortality generally translates into increased contrasts, thus degrading the visual scene for some visitors.

Effects of the Alternatives

There are two distinct ways the alternatives affect recreation-related use. The first is the degree to which alternatives limit access. Access and availability of public lands for recreation use is a key variable used for analysis of each alternative. Existing levels of availability of public lands for recreation use is deemed adequate at this time. The second is the degree to which the alternatives contribute to esthetic resources by maintaining POC over the long term.

It is assumed that increasing human populations within the area would increase recreation use of public lands. Demand would increase relative to growth. Cumulative effects would be relative to levels of increased demand and reduced availability.

Off-highway vehicle use, horseback riding, and all vehicular use are recognized as probable PL export agents, and thus are most affected (targeted) by any use restrictions. Saddle and pack stock require reasonable watering opportunities, increasing the probable exposure to POC and PL areas.

Although the standards and guidelines of the various alternatives generally do not affect wilderness or wilderness study areas directly, each of the alternatives could allow for varying levels of introduction of PL into the wilderness units via foot and horse traffic. There would be a resultant reduction in visual quality and related recreation experience.

Alternative 1

Access to and availability of public lands for recreation use appears to be adequate for present demand. Any effects associated with this alternative would increase or decrease based on the level of access provided to the public. Current direction allows for gating or barricading roads to protect POC when consistent with other resource objectives. A desire to maintain public access is always a major concern whenever a road closure is considered. Public input and feedback thus far has generally not indicated a perception of overly-restricted access. Various other road closures have occurred for other resource-related reasons, and have generally not elicited noticeable public resistance (except in isolated circumstances). As future use increases—depending upon the level of road or seasonal restrictions imposed—demand could be displaced to other lands, resulting in a reduction in the quality of user experience.

This alternative would result in infestation of 48 to 52 percent of high-risk areas (those most associated with water) throughout all portions of the range except at Coos Bay BLM District/ Siskiyou NF Powers Ranger District. There would be a corresponding reduction in the aesthetic environment to individual recreationists. The visual quality of the characteristic landscape could suffer degradation until stands recover with replacement conifer species.

Alternative 2

Effects of Alternative 2 are similar to Alternative 1. Management Practices 8 (Routing Recreation Use) and 9 (Road Management Measures) are probable effect-producing actions depending on the degree of the closure or restrictive action. Application would be variable depending upon POC and PL locations and the nature of the use or activity—there is no reliable indicator of the totality of any effect. These types of actions have already occurred over the past decade for various management reasons throughout the area. Individual occurrences of such management actions would require specific analysis based on their scale and scope and the interest level and nature of stakeholders affected. Depending on the relative importance of certain roads or road systems to particular user groups, controversial or recreation-impacting closures could occur. As future use increases—depending upon the level of road or seasonal restrictions—demand could be displaced to other lands, resulting in a reduction in the quality of user experience.

Given the flexibility of management options within this alternative, and the unlikelihood of substantial decreases in access or availability of recreation opportunities when compared with the current direction, access effects associated with this alternative are considered negligible.

This alternative would result in infestation of 45 to 50 percent of high-risk areas (those most associated with water) throughout all portions of the range except at Coos Bay BLM District/

Siskiyou NF Powers Ranger District. As in Alternative 1, there would be a corresponding reduction in the aesthetic environment to individual recreationists. The visual quality of the characteristic landscape could suffer degradation until stands recover with replacement conifer species.

Alternative 3

In addition to the effects described for Alternative 2, Management Practices applying to POC cores, Management Practices 1 (Minimize Entry), 3 (No Vehicles), and 6 (Trails) are probable effect-producing actions. Depending on the level of closure involved, the effect would range from "low" to a level where existing demand for access and availability is not being met, and recreationists (especially off-highway vehicle users) would be displaced to other lands, decreasing the quality of the recreation experience for the user.

POC buffer protection Management Practice 1 (Transportation Analysis) is a probable effect-producing action. The level of availability of roads for public use, and the resulting effects, are the same as those described for the Management Practice 3 (No Vehicles) above.

This alternative would result in infestation of 32 to 37 percent of high-risk areas (those most associated with water) throughout all portions of the range except at Coos Bay BLM District/ Siskiyou NF Powers Ranger District. Although less than Alternative 1 and 2, there would be a some reduction in the aesthetic environment to individual recreationists. The visual quality of the characteristic landscape could suffer degradation until stands recover with replacement conifer species.

Alternative 4

Removing existing POC disease-prevention practices would have little effect on the availability of recreation opportunities on public lands. The lack of closures or access restrictions would, however, lessen the likelihood of impacting an individual user group concerned about losing access to a favorite area. This alternative would also decrease the likelihood of displacement-related congestion in other areas in the future.

This alternative would result in infestation of 83 to 85 percent of high-risk areas (those most associated with water) throughout all portions of the range except at Coos Bay BLM District/ Siskiyou NF Powers Ranger District. Recreation activities that may be linked with the occurrence of POC (camping in sites dominated by a POC overstory, certain photographic activities) would be affected. The effect would simply be the loss of the aesthetic environment that served as a draw to individual recreationists and a backdrop for their chosen activity.

Visual resources would be affected by the eventual loss of POC—effects would vary depending on the amount of POC in a viewshed. The visual quality of the characteristic landscape could suffer degradation until stands recover with replacement conifer species.

Alternative 5

Similar to Alternative 4, removing existing POC disease-prevention practices would have little effect on the availability of most dispersed recreation opportunities on public lands.

The lack of closures or access restrictions would, however, lessen the likelihood of impacting an individual user group concerned over lack of access. This alternative would also decrease the likelihood of displacement-related congestion in other areas in the future.

This alternative would result in infestation of 83 to 85 percent of high-risk areas (those most associated with water) throughout all portions of the range except at Coos Bay BLM District/ Siskiyou NF Powers Ranger District. Recreation activities that may be linked with the occurrence of POC (camping in sites dominated by a POC overstory, certain photographic activities) would have an affect on the enjoyment of these activities. The effect would simply be the loss of the aesthetic environment that served as a draw to individual recreationists and a backdrop for their chosen activity.

Visual resources would be affected by the eventual loss of POC—effects would vary depending on the amount of POC in a viewshed. The visual quality of the characteristic landscape could suffer degradation until stands recover with replacement conifer species.

Areas of Critical Environmental Concern and Research Natural Areas

Affected Environment

As a part of the preplanning process for the SEIS, the staff considered and evaluated all lands within the Oregon range of POC that are designated areas of critical environmental concern (ACECs) and/or research natural areas (RNAs). "The Federal Land Policy and Management Act" and BLM policy require the BLM to give priority to designation and protection of ACECs during the land use planning process (USDI-BLM 1988). ACECs are areas within BLM-administered lands where special management is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or natural systems or processes, or to protect life and safety from natural hazards. Appendix 8 contains a complete description of the ACEC criteria.

ACECs may be nominated by members of the public, other agencies, and BLM staff at any time. BLM policy requires that RNAs be managed as ACECs; therefore, areas nominated as RNAs must meet the ACEC criteria. RNA management goals and plans are usually more restrictive than ACEC management alone, as RNAs are created for scientific research and should maintain values for the representative cells and values.

Existing Areas of Critical Environmental Concern

At present there are 28 existing ACECs or RNAs in the range of POC in Oregon (there is no POC on BLM lands in California). See Appendix 8 for a listing of these ACECs and their size, primary objectives, and other management information. Appendix 8 also includes the process and requirements for designation of ACECs.

Management activities in or near ACECs must be implemented in such a manner so as to be compatible with specific management objectives identified in site-specific activity management plans. In general, direction requires the BLM to: (1) manage ACECs for the maintenance, protection, or restoration of relevant and important resource values; (2) manage RNAs for the purpose of scientific study, research, and education, and to provide a baseline against which human impacts on natural systems can be measured; and (3) manage outstanding natural areas for recreation in a way which will not damage the natural features that make the area outstanding.

Management plans for each area will address such actions as land acquisition, use of prescribed fire, interpretation, introduced species, fire suppression, domestic grazing, insects and disease, public use, minerals, and hydrology. Direction requires pursuit of mineral withdrawals for all RNAs; the inventory and designation of new RNAs as appropriate "cells" are identified, a limitation of off-highway vehicle use in all special areas to existing roads (unless closed), and development of monitoring plans that address ecological status, defensibility, and compliance monitoring issues.

Effects of the Alternatives

Nine of the ACECs are not known to have POC; hence, there is no effect under any of the alternatives. Fourteen ACECs or RNAs have POC and no known root disease. Thirteen of these ACECs or RNAs were selected at least partially for the presence of POC plant communities. Five ACECs or RNAs currently have root disease. Four of the infested ACECs or RNAs were selected at least partially for the presence of POC plant communities.

The risk to any specific ACECs or RNAs is generally the same as percentages described in the Pathology section for each alternative. Under Alternatives 1, 2, and 3, management plans for the ACECs or RNAs would be developed where they do not exist and these areas would be managed to reduce the spread of (or possibly eliminate) PL, according to the standards and guidelines of the selected alternative. Under Alternatives 4 and 5, existing areas of PL would remain untreated, placing those ACECs or RNAs selected for the presence of POC plant communities at higher risk of losing those values for which they were selected. These alternatives would raise the probability of infestation occurring, particularly on sites favorable for the pathogen, compared to Alternatives 1, 2, and 3.

Culturally Significant Products for American Indian Tribes

Affected Environment

The current range of POC falls within the traditional territories of numerous American Indian Tribes along the west coast of North America. Included is the 5,400-acre forest of the Coquille Indian Tribe in west-central Oregon that must be managed according to the standards and guidelines of adjacent Federal land. Other Tribes in Oregon and California also manage lands containing POC, but these are not directly affected by the management requirements of the various alternatives. POC continues to play a significant role in the cultural and religious life of many Tribes living within the POC range from west-central Oregon south through northwest California. Native cultures toward the northern end of the POC range suffered more severe disruption during U.S. settlement of the region in the mid-19th century than those toward the southern end of POC range. As a result, POC use was largely disrupted and information is limited. Specific information concerning where, how, what time of year, and by whom POC is harvested and used is restricted from distribution.

Cedars of all type are considered the most used wood by native cultures of the Pacific Northwest. Despite declining availability, the cultural importance of POC remains high given its physical and structural characteristics, distinctive appearance, and aroma. The smells of POC also enhance the meaning of cultural rituals. Known for its durability, POC has straight grain properties allowing it to be split evenly. In contrast, spruce, which is also valued, does not split as evenly and has more pitch. Therefore POC is sought as a source of planks for building traditional structures and for arrows or lances that support bone or stone projectile points. However, shortages and diminishing accessibility to mature trees sometimes relegates POC to parts of a plank house or sweat lodge, such as benches or sidewalls. This is also true for construction of canoes.

POC has other traditional uses. Boughs are used as brooms, and the bark and roots are peeled and at times finely shredded for use in making traditional clothing, basketry, nets, twine, mats, and other items. Limbs may be twisted into rope.

Unlike western red cedar and incense cedar, POC has limited medicinal value due to its highly toxic character as a diuretic. Similarly, POC is less effective than incense cedar for preserving and storing perishable materials such as feathers, hides, and other materials. POC typically does not have the cedar-closet aroma of other cedars.

The declining availability of healthy mature POC trees through the 20th century however has increased the importance of remaining POC stands to Tribes. Although the region has experienced an economic and cultural rejuvenation by the Tribes, a declining availability of POC due to several factors including past timber cutting, disease, endangered species protection, fish protection, and land use allocations hinders Tribal initiatives to restore and revive cultural traditions.

Agencies issue permits for collection of special forest products including non-POC boughs, beargrass, and cones, but seldom issue permits for POC product collections. Therefore, quantitative data concerning modern-day cultural uses of POC is highly variable among the Tribes and generally not readily available outside Tribal communities. In general, however, use of POC is at modest levels. No information is available regarding the association of other culturally important species associated with the occurrence of POC.

Maintenance of POC stands on Federal lands as a culturally-important species is important to Tribes and fulfills Federal policies and goals for accommodating traditional Tribal uses. These uses are also consistent with the "American Indian Religious Act," and other statutes that highlight the importance of traditional cultural uses of plants on Federal lands. There are no effects to the exercise of those rights, because there are no off-reservation treaty reserved rights within POC range.

Effects of the Alternatives

There are two distinct ways the alternatives affect Tribal uses of POC products: (1) the degree to which alternatives limit access to products, and (2) the degree to which the alternatives maintain collectable quantities of POC over the long term.

Access to Products: Access is least restricted in Alternatives 4 and 5, and more restricted with Alternatives 1, 2, and 3. For example, Alternatives 1, 2, and 3 include a variety of

Management Practices including sanitation measures (removal of roadside POC in disease infested areas), road construction restrictions, restrictions on harvesting boughs, and washing vehicles accessing diseased areas. Alternative 3 would result in further access restrictions in some watersheds. However, because of the modest demand and the availability of at least some products from private lands, the actual difference between the alternatives is extremely small, perhaps affecting less than one collection request per year in the most restrictive case of Alternative 3. Further, the adverse effect on access is more than compensated for, in the view of the Tribes, by what they view as the long-term benefits of reduced access. The Tribes contacted for this SEIS felt strongly that slowing the spread of the root disease was important to protect their cultural uses. Many responses advocated limiting access to areas to achieve that goal by restricting the introduction of disease-infested soil.

Maintain Collectable Quantities: Even though access and collection restrictions of some alternatives may remain in place indefinitely, the effect on Tribes depends primarily on the amount of healthy POC that would be provided by each alternative over the long term.

An analysis of the five SEIS alternatives on the spread and impacts of PL on POC stands reveals useful trends in determining the implications for availability of POC on Federal lands for cultural use. The pathology effects section indicates the five alternatives pose insignificant differences for POC stands in low-risk areas. The occurrence of low-risk areas varies greatly in the POC range, from 80 percent of the area in the northern coastal areas of western Oregon, to 60 percent in the southern coastal range of California, and 40 percent in inland areas of POC. The analysis does indicate significant differences posed by the alternatives on high-risk areas within the region. Therefore, only 20 percent of the northern coastal range shows significant variation in results of the alternatives over a 100-year period. This increases to 60 percent in the further inland areas. The analysis further determines for uninfested high-risk sites that the alternatives would lead to the following infestation rates over the next 100 years (from Table 3&4-8 in the Pathology section):

Alternative 1 — 40 percent;
Alternative 2 — 35 percent;
Alternative 3 —20 percent;
Alternative 4 — 80 percent; and
Alternative 5 — 80 percent.

Those stands newly infested are expected to experience a 90 percent mortality rate within 20 years or less of becoming infested.

The primary difference in alternatives is in the application of management actions to prevent/reduce the spread of disease in uninfested areas of Alternatives 1, 2, and 3, and the lack of such provisions in Alternatives 4 and 5. However Alternative 4 includes a strong emphasis on disease resistance breeding in POC planting stock, which would increase the availability of POC products as they grow older.

Given the following factors that: (1) the alternatives only vary significantly for high-risk sites in regard to rate of disease spread; (2) Tribal reliance on POC stands for culturally important products is at modest levels; and (3) under all alternatives some level of healthy accessible POC stands would be sustained over the 100-year analysis period, the difference in effects on Tribal use of POC among Alternatives 1 through 5 is immeasurable. It should be noted however that Alternative 5 poses a potentially greater effect over a longer time span because it combines lack of disease prevention measures with a non-aggressive genetics program, and thus could impact Tribal product availability more than for the other alternatives. However, the difference will be insignificant through the 100-year period addressed by the SEIS.

Note: Persons contacted in soliciting information for this section included Don Ivy and George Wasson of the Coquille Indian Tribe, the Hoopa Tribe Forestry Department, Jason Younker of the University of Oregon, Forest Service Region 6 Tribal Affairs Specialist Les McConnell, land management agency Cultural Resource Specialists Dr. Steve Samuels, Isaac Barner, Dr. Mike Southard, and Reg Pullen.

Special Forest Products

Affected Environment

POC shares the same decay resistant properties as other cedars, such as western red cedar and incense cedar, and is used for posts, rails, and shakes. Western red cedar and incense cedar are more sought after because they have a wider range and are more easily accessible.

POC is in greatest demand for boughs during Christmas and to a lesser degree, for year-long floral arrangements. Boughs have a graceful, flat, beaded-lace appearance that makes them ideal for tying continuous strands to a wire backing for garlands or for layering into Christmas wreaths. The foliage also combines beauty with durability and needle retention that allows it to be preserved with glycerin mixtures for long-lasting floral displays. These attributes make POC a desirable commodity for personal use and commercial harvest. Commercial buying sheds in southwest Oregon purchased more than 400,000 pounds of POC boughs during 2002, yet less than 4 percent came from Federal land. The existing market for POC boughs could accommodate an increase in Federal bough supply either through expansion of demand or substituting POC boughs for western red cedar boughs. The price paid by the sheds ranged from $0.25 to $0.35 per pound, making POC economically desirable to harvest during a time of year when other agricultural work is diminishing.

The nature of commercial POC harvest involves an individual or crew making numerous trips from a vehicle into a grove of POC to clip and carry bundled boughs back to the road. Typically, a road will bisect several draws in a drainage growing POC, and harvesters will drive a road visiting and collecting from each draw. Greatest demand is prior to Christmas, typically a wet time of year, which increases these chances of moving infected soil by mud on shoes or vehicle tires. The intensity and focus of the foot traffic during commercial harvest in POC groves makes this a higher risk activity for PL spread than incidental foot traffic from hiking, hunting, or gathering of other special forest products such as mushrooms.

In addition to spring and fall mushroom gathering, other products potentially sharing range with POC or in demand during the wet season include firewood and Christmas trees. Each of these activities requires a permit, so there are opportunities to close areas and direct collectors to areas with low risk. Within the range of POC, the Agencies issue approximately 800 personal use firewood permits, 1,200 mushroom permits, and 2,900 permits for individual Christmas trees each year. Closures of road systems that pass through POC range could affect access to Christmas tree cutting areas or limit availability of firewood permits. Mushroom gatherers using road systems for access or walking through the woods between infected and uninfected areas may be affected either by road closures, spread control techniques, or denial of permits.

Effects of Alternatives

The effects of the alternatives are based entirely on management constraints to the program. POC products are such a small percentage of the live POC on Federal lands that mortality differences between the alternatives are deemed to have little potential to affect supply in the foreseeable future.

Alternative 1

This alternative continues the current direction in the land and resource management plans of the BLM Districts and the Siskyou NF. Limitations on the harvest of POC boughs, stemming in part from incompatibility with the objectives of various land use allocations, and in part because of concerns about the role of bough collection in the spread of POC root disease, would continue. The level of harvest activity from Federal lands is expected to continue to provide only a small percentage (less than 4 percent) of total harvested boughs in southwest Oregon. Other special forest product opportunities within the range of POC are expected to continue at their present levels.

Alternative 2

Alternative 2 is similar to Alternative 1, except that practices currently implemented or recently developed are better described, and a risk key is included for clarification of the environmental conditions that would trigger additional control or mitigation measures. Implementation of disease-control practices is expected to be somewhat more consistent than under Alternative 1. Bough harvest is expressly prohibited, except under specified permit conditions. There will be instances where site-specific analysis of a project would require the undertaking of some proactive POC roadside sanitation. These projects could provide several tons of boughs with the utilization of the severed trees. This translates into the level of bough harvest activity from Federal lands remaining approximately the same, or slightly higher, than current levels. Additionally, there may be road management practices that would result in a slight decrease (less than 5 percent) in other special forest products permits for firewood and Christmas trees due to restricting access to lands during the wet season or closing roads. Areas for firewood or Christmas tree cutting outside these closure areas are generally available to accommodate these requests.

Alternative 3

Alternative 3 incorporates all of the direction from Alternative 2, and adds protections for uninfected watersheds by creating POC core areas totaling 34,000 acres (or over 10 percent of the land base occupied by POC). The key management directives for these POC core areas relevant to this analysis is (1) closing of some road systems, and (2) suspension of all special forest products permitting in these areas. However, as in Alternative 2, there would be POC sanitation projects (including in POC buffer areas) that could provide several tons of boughs for utilization. As with Alternatives 1 and 2, the availability of boughs is tied primarily to sanitation and other management activities, which would remain similar to current levels or increase slightly. Hence bough availability under this alternative would be approximately the same as current levels.

With restricted road access and special forest products permits in the POC core areas, and additional road closures or seasonal limitations put on activities in POC buffers (approximately 33 percent of the Federal land within the POC range in Oregon), there is an expectation of a slight decrease in mushroom, firewood, and Christmas tree special forest products permits. Because much of the core and buffer areas are in wilderness or roadless areas, any reductions in available collection areas would be small enough to be essentially negated through permitting in other areas.

Alternatives 4 and 5

Alternatives 4 and 5 remove the current management techniques used to control the spread of PL and are differentiated only by the increase of the disease-resistant seed program in Alternative 4 and discontinuing the resistance breeding program in Alternative 5. The effects for both alternatives with regard to special forest products would be similar. In the long term, a program of growing and planting seedlings may offer more opportunity for bough harvest than natural regeneration alone may offer, but plantings of disease resistant trees are not expected to be subject to bough cutting within the near future. Depending on Agency funding for the preparation and administration of bough sales increases, there would be a enough market and product availability to support 100 to 200 tons of bough collection per year. Additionally, there may be a slight increase in other special forest products permits due to increased access to lands, including during the wet season.

Timber Harvest

Affected Environment

Timber harvest occurs for a variety of reasons on the BLM and FS units within the range of POC. An understanding of timber harvest activity and the lands involved is important to calculating the effects of the alternatives on future timber harvest. It is also illustrative about the amount and nature of harvest activity on public lands, acknowledged to be a factor in POC root disease spread.

Probable Sale Quantity (PSQ)

Long-term sustained-volume production is a goal on about 11 percent of the Federal forestlands within the range of POC, all within the Matrix and Adaptive Management Area land allocations. These lands are managed for regularly-scheduled timber harvest while meeting a nondeclining yield policy objective (Table 3&4-22).

The annual volume expected to come from these lands is called probable sale quantity, or PSQ. The decisions regarding how exactly to harvest in the Matrix and Adaptive Management Areas, and what schedule to use, are made after considering a variety of nontimber resource values at the administrative unit, watershed, and site-specific scales. PSQ levels are established in the land and resource management plan for each administrative unit, and

Table 3&4-22.— Acres by Northwest Forest Plan land allocation and administrative unit within the range of Port-Orford-cedar in Oregon

currently reflect the plan amendments of the Northwest Forest Plan (USDA and USDI 1994b) (Table 3&4-23). No previous PSQ adjustment was made for the current POC standards and guidelines. For the purposes of this analysis, it is assumed that PSQ is directly proportional to the forested lands dedicated to its production. That means for each acre removed from the Matrix or Adaptive Management Areas, there is a proportional and nearly straight-line reduction in PSQ. As noted in the Assumptions section earlier in this chapter, the following discussion assumes full implementation of the Northwest Forest Plan volume, and other Northwest Forest Plan objectives.

On most Oregon management units, POC is more concentrated toward the riparian areas and therefore, contributes little to PSQ. Across all land use allocations and topographic positions in Oregon, there are an average of five POC trees per acre in the 1 to 7 inch dbh (diameter at breast height) class, three in the 7 to 20 inch class, and one over 20 inches dbh, per acre. On Coos Bay BLM lands and on the Powers Ranger District of the Siskiyou NF POC is more well-distributed across the landscape. As a result, around 5 percent of the volume in any given harvest unit might be POC. Disease-related mortality does not necessarily affect PSQ at all. The dead trees in the Matrix are salvable, and the growing space, if not readily captured by existing competitors, can be restocked with resistant POC or other tree species. On other units where POC is more concentrated toward the riparian areas, little of it contributes to PSQ.

Table 3&4-23.— Annual probable sale quantity (PSQ) in millions of board feet annually by administrative unit and within the range of Port-Orford-cedar[1]

Other Harvests

A strength of the Northwest Forest Plan is the expectation that commercial thinning will be done in Late-Successional Reserves and some Riparian Reserves to help these lands meet their primary objective of becoming habitat for late-successional forest-related species or contributing to achievement of water quality objectives. Harvest is typically limited to thinning in stands less than 80 years old, but may take place in older stands if necessary to reduce the risk of a major fire. The resultant volume does not contribute to PSQ and there is no programmed level of harvest. Nevertheless, recent Late-Successional Reserve harvest activity has taken place at an estimated rate of 3 million board feet per year and 300 acres per year on all the Oregon management units combined within the range of POC. There is a considerably higher capacity for these treatments. About 20 to 30 percent of all Late-Successional Reserve acreage within Northwest Forest Plan area are between 30 and 80 years of age and would benefit from such thinning. Within the Oregon portion of the POC range, the potential for these treatments is estimated to be about 85,000 acres.

Salvage activities may also take place in most land allocations (an exception is Congressionally Reserved), depending upon the magnitude of the disturbance event. Late-Successional Reserves permit salvage if an event such as a fire has reduced canopy cover below 40 percent on an area larger than 10 acres. Salvage is proposed, for example, within the 2002 Biscuit Fire area. Annual levels of salvage volume are highly variable.

Harvest Activity Implications

Harvest volumes per acre are variable depending upon the land allocation and whether a complete (regeneration), partial (thinning), or salvage harvested, but it would be reasonable to estimate about 20,000 board feet per acre is average. Further, the average logging truck carries about 5,000 board feet. Finally, the ratio of tractor or cable partial-suspension to full suspension (ground-based to nonground based) logging is about 80:20. With these numbers, general levels of ground-disturbing activities related to logging can be calculated.

Annual volume harvested on Federal lands in the Oregon portion of the POC range is about 51 million board feet (PSQ plus reserve thinning volume). This would represent harvest on approximately 2,500 acres per year, with 80 percent tractor or partial-suspension harvest methods generally moving some dirt. With 20 percent of the range actually having POC, and 9 to 15 percent of that being infected with PL, 45 to 125 acres of harvest are likely to run through PL-infested soils in any given year, and have the potential to move them around.

Further, transporting the annual volume from the forests in Oregon requires about 10,000 truck trips, traveling to various mills sometimes not even in the same state. For California, the 24.5 million board feet being harvested within the range of POC translates to another 4,900 truck trips. Timber management personnel from the northern California Forests estimate the amount of wood traveling into Oregon from their timber sales is less than 2.5 million board feet per year, about 500 truckloads, or about 5 percent of the truckloads generated within Oregon. These trucks are coming from potentially infected areas. Until recently, much of this timber was trucked directly into the Rough and Ready Mill at Cave Junction, Oregon. Recently, the Rough and Ready Mill closed and the amount of wood being hauled into Oregon would be much reduced, probably far less than 300 truckloads per year. A potential for exchange of spores at mill yards and the use of logs and logging trucks as infection vectors is probably very slight, given sale mitigations measures and poor spore survival under high temperatures (Goheen, D.J., *personal communication*).

On Federal lands, all harvests are done by the highest qualified bidder or their agents, using their own logging equipment. There is the possibility of infestation being spread throughout the range or from state to state with this equipment. Equipment used on private lands within the range of POC is not subject to the mitigations and seasonal restraints applied to Federal timberlands. This may be a particular concern with equipment from the Port Orford to Coos Bay area where the level of infestation on private lands is higher than on any of the Federal lands in this analysis. For these reasons, a key element of the current POC management practices is cleaning equipment before permitting a purchaser to work in or near uninfested POC stands on Federal lands.

Effects of the Alternatives

There are three possible ways the alternatives could affect the level of timber harvest. First, to the extent PL kills trees important to PSQ, the alternatives with the highest mortality would be the ones to most affect timber harvest. As noted in the Affected Environment section, this element has virtually no effect on PSQ either because POC are not well represented in the Matrix/Adaptive Management Area land allocations, or because they could be salvaged anyway and their growing space in most stands would be readily utilized by resistant stock or other species.

Second, if the standards and guidelines actually prohibit harvest on certain acres, there is a direct and proportional reduction in harvest levels. This is the case in Alternative 3 with the establishment of POC cores. Thirdly, if the standards and guidelines result in increased cost, some areas (when considering all of the other costs that go into timber sale economics) may become too expensive to harvest. This effect is real, but very difficult to quantify at the programatic scale.

Alternatives 1 and 2

These alternatives are essentially the same in their effects to PSQ. Neither prohibits harvest on any lands, but both increase costs. Estimates listed in the cost section for washing ($28,000 and $22,000 for Alternatives 1 and 2, respectively) and a portion (33 percent) of the $37,000 sanitation costs ($51,000 and $41,000 for Alternatives 1 and 2, respectively), are probably directly attributable to timber sales and borne by purchasers. This is about $0.80 per thousand board feet. Seasonal restrictions can also reduce the availability of prospective bidders, thereby reducing bid rates and Federal receipts.

Additionally, the standard and guideline in Alternative 2 that encourages nonground based equipment would increase harvest cost an undetermined amount compared to Alternative 1.

Alternative 3

In addition to the effects listed for Alternatives 1 and 2, Alternative 3 prohibits timber harvest within 2,281 acres of Matrix and Adaptive Management Areas in the 32 currently uninfested watersheds. To the extent these POC cores overlap with Matrix and Adaptive Management Area acres, there is a direct effect on PSQ. Map 1 shows the extent of this overlap. The acres for POC cores in Matrix/Adaptive Management Area/Riparian Reserve are shown on Table 3&4-3. Riparian Reserve acres are lumped with Matrix and Adaptive Management Area in Agency databases because there is no good way to completely account for Riparian Reserves with GIS mapping. Instead, a reduction factor is applied that reflects each administrative unit's experience with Riparian Reserves and nonforest acres, to calculate affected Matrix/Adaptive Management Area PSQ acres, and from here the potential PSQ reduction (Table 3&4-24).

Total PSQ reduction is about 0.7 million board feet in the Oregon portion of the POC range, or about 1.7 percent. There would be a proportional reduction in jobs, and in harvest acres and logging trucks. As noted in footnote 2 of Table 3&4-24, this may not all be attributable to Alternative 3— a significant portion of the uninfested watersheds on the Siskiyou are in roadless areas.

There is no prohibition of harvest in POC buffers designated under Alternative 3, so they have no effect on PSQ.

This analysis is not intended to be precise enough to redeclare PSQ, but provides a general quantification of the effects of this alternative. Precise PSQ calculations would require identification of the actual affected stands in unit databases and then rerunning each unit's harvest scheduling model without those stands.

The restriction against timber harvest in the POC cores will also restrict the ability of the Agencies to do commercial thinning on approximately 6,000 acres of 40- to 80-year-old stands in Late-Successional Reserves (approximately one-third of the Late-Successional Reserve acres in these watersheds). This thinning is done to accelerate the development of late-successional forests or restore ecological processes. Such thinning is a major strength of the Northwest Forest Plan, but with nearly 2,000,000 acres of thinning needs in the Northwest Forest Plan area, this 6,000 acres may not be significant unless it conflicts with specific identified habitat or fuel reduction thinning plans. This could occur, however, because a portion of these acres appear to be in the unburned wildland/urban interface along the west-

Table 3&4-24.— Alternative 3 Port-Orford-cedar core acres and resultant PSQ reduction for Oregon ern edge of the Illinois Valley.

Alternatives 4 and 5

These alternatives would not affect PSQ because they do not make any acres unavailable for timber harvest. The $0.80 per thousand board feet cost, the seasonal restrictions, and the extra cost for nonground-based logging equipment of Alternatives 1 and 2 would be gone.

Costs

Affected Environment

Introduction

Presently, Federal Agencies use a number of program activities to lessen the spread of PL. These efforts cost money that is ultimately borne by the Agencies, either directly or indirectly. Direct program costs are paid via Agency appropriated funds for such things as labor, vehicles, equipment, and facilities. Almost all of the POC program costs, in fact, are funded in this manner. The direct program activities include such costs as the design, sale, and administration of POC special forest products; the design, conduct, and administration of POC timber sale and service contract stipulations; program monitoring; resistance breeding; planting POC; and overall program management.

Direct costs related to mitigating adverse effects of spreading the pathogen, but within the context of larger, unplanned activities, such as wildfire suppression costs of washing fire vehicles or treating water with Clorox, are not captured in this analysis. On the Biscuit Fire of 2002, approximately $1.5 million was spent for vehicle washing, dust abatement, and treatment of firefighting water with Clorox (see Chapter 3&4, Fire and Fuels, Wildland Fire Suppression subsection).

Indirect program costs more integrally interwoven into general Federal land management practices have not been captured or analyzed. For example, best management practices to benefit POC management objectives, such as appropriate road drainage design, are components of specific projects that are not distinguishable as POC program costs. Since these indirect program costs are not easily quantifiable, they are not included here. They are a relatively small, but not necessarily insignificant, part of the total cost for these activities. Also not included are general overhead and support costs. The following discussion covers only identifiable direct POC program costs.

Existing Costs by Program Activity

POC program work-units and unit costs are grouped into the following eight basic program categories. In this analysis, reported Federal administrative unit costs were used to calculate Alternative 1 costs. The total direct program costs are estimated at $860,000 per year. This is the Alternative 1 cost displayed in Table 3&4-25 in the following Effects of the Alternatives section.

Program Costs: Under the current conditions of Alternative 1, labor costs for two full-time

Agency program managers and District support personnel, for the BLM and USFS respectively, are the principle costs. Included in their expenses are vehicles, supplies, and travel costs. In addition, there are other employees designing and administering elements of the program with similar program costs. The costs of the FS disease pathologists providing regional consultation for POC are included in this element. The total program costs for Fiscal Year 2002 are estimated at $348,000.

Eradication: In the last 7 years, only one eradication project has been completed, at a cost of $23,000. A follow-up treatment is estimated to cost $5,000. With the $28,000 spread over a 7-year period, the average annual cost is $4,000.

Roadside Sanitation: In a recent survey of all BLM and FS Oregon administrative units, sanitation costs were estimated to be $2,500 per mile for removal of unmerchantable POC on about 20 miles of roads per year. The total annual cost for roadside sanitation is approximately $51,000.

Roads/Trails: Current treatments include renovation or relocating existing roads, road closures, and moving trails. These costs are estimated at $37,000 per year.

Washing: Current costs of washing applied to timber sale contracts average approximately $2,700 per sale. Analysis for Alternative 1 assumed 1.5 timber sales per year for each of the four administrative units. Under service and construction contracts, there is an average of six contracts per year per administration unit, with an average estimated washing cost of $500 per contract. The existing washing cost is estimated at $28,000 per year.

Port-Orford-Cedar Special Forest Products: Under current management direction, only one administrative unit sells POC boughs. It costs that unit approximately $5,000 per year to manage these sales.

Resistance Breeding: BLM and the FS spent $333,000 in Fiscal Year 2001 on the resistance breeding program. As described in an interagency agreement between the BLM and FS (USDA-FS and USDI-BLM 2002), the costs for Fiscal Year 2003 are $369,000 for the resistance breeding program.

Monitoring: Present POC monitoring includes field measurement and evaluation of common garden study sites, operational project monitoring, semiannual technical review of POC research, and annual program reviews by each administrative unit. These costs are estimated at $6,000 per year. It should be noted that some of the above POC program treatments are often undertaken for other reasons. Roadside sanitation, for example, is partially accomplished as a by-product of routine roadside brushing.

Effects of the Alternatives

Alternatives 2, 3, 4, and 5 costs are predicted using Alternative 1 as a baseline and then adjusting each expected alternative costs based on the differences in the standards and guidelines for each alternative. A summary of this data is shown in Table 3&4-25.

Program Costs: There would be no change in costs with the implementation of Alternatives 2 or 3. These costs cease under Alternatives 4 and 5.

Table 3&4-25— Summary of average annual Port-Orford-cedar program costs ($) by category and alternative

Eradication: It is assumed that under Alternative 2 eradication treatments would be tried more regularly than under current practices. With a 50 percent increase under this alternative, the cost would be $6,000 per year. Eradication treatments are predicted to triple under Alternative 3, to three eradication projects needed every 7 years under this alternative, because of aggressive action to eliminate new infestations in the POC core areas within the 32 uninfested watersheds. The average annual costs under Alternative 3 would be $12,000. Alternatives 4 and 5 would not use eradication.

Roadside Sanitation: Use of the site-specific POC Risk Key under Alternatives 2 and 3 permits better identification of areas not needing treatment in the North Coast Risk Region. There will probably be less roadside sanitation on the "checkerboard" lands of the BLM districts under Alternative 2, and about the same level as under Alternative 1 on the remainder of the range. It is projected that this would result in a 20 percent decrease in the road miles treated, and a projected cost of $41,000 per year. With Alternative 3 there would still be a probable decrease in roadside sanitation on the "checkerboard" lands of the BLM Districts; however, this would be offset by the increase in roadside sanitation in the POC buffers of the uninfested 6th field watersheds. It is estimated that this cost would be the same as Alternative 1, $51,000 per year. Alternatives 4 and 5 assume that no roadside sanitation would be done, so there are no costs.

Roads/Trails: The POC Risk Key described as part of Alternatives 2 and 3 would dictate appropriate road and trail management actions. Cost-effectiveness criteria, as defined by the Purpose statement of this SEIS, may further direct proposed actions to not necessarily treat roads and trails themselves, but to mitigate their effects on POC. An example of this rationale could be to sanitize a given road system rather than surfacing it. Most of the road renovations, relocation of existing roads, road closures, and moving of trails has previously occurred on the Siskiyou NF and would continue at the level identified for Alternative 1. Alternative 3 requires additional road treatments to protect POC core areas. However, many of the POC core areas are in withdrawn land uses or administratively designated roadless areas. There is a projected 30 percent increase in road relocation and closure cost under Alternative 3, for at total cost of $48,000 per year. Under Alternatives 4 and 5 road projects to specifically address POC considerations would not be done.

Washing: Similar to the discussion for roadside sanitation, the use of the site-specific POC Risk Key under Alternatives 2 and 3 provides greater predictability about the level of vehicle washing that will take place. There will probably be less vehicle washing within the "checkerboard" lands of the BLM districts under Alternative 2, and about the same level as under Alternative 1 on the remainder of the range. It is projected that this would result in a 20 percent decrease in the amount of vehicle washing and a projected cost of $22,000 per year. With Alternative 3 there would still be a probable decrease in vehicle washing within the "checkerboard" lands of the BLM districts, but this would be offset by the increase in washing in the POC buffers of the uninfested 6th field watersheds. It is estimated that this cost would be the same as Alternative 1, $28,000 per year. Washing for lessening the probability of long-range PL spread would continue for Alternatives 1, 2, and 3. Alternatives 4 and 5 would terminate present washing expenditures.

Port-Orford-Cedar Special Forest Products: Alternatives 2 and 3 would not change this expenditure, while Alternatives 4 and 5 would terminate special permit administration related to PL control, and related cost.

Resistance Breeding: Actual costs for Fiscal Years 2001 through 2002, and projected costs for Fiscal Years 2003 through 2006, as described in a BLM and FS interagency agreement is used as a basis to estimate the resistance breeding program costs (USDA-FS and USDI-BLM 2002). For the last 4 years of the 10-year analysis period, breeding costs are assumed to remain level at $350,000 per year. Included in these costs are breeding monitoring costs. Also, increases or decreases of these costs for Alternative 4 or 5, respectively, were estimated by the FS Dorena Genetic Resource Center personnel. Associated field work, such as new field selections, would remain the same for Alternatives 1, 2, and 3, accelerate under Alternative 4, and not occur under Alternative 5.

Monitoring: Alternative 2 would leave these costs unchanged. Alternative 3 would require one-third more administrative monitoring to maintain disease-free POC cores and buffers. The cost for Alternative 3 monitoring would be $8,000 per year. Alternatives 4 and 5 eliminate many of the monitoring elements contained in Appendix 5, Monitoring. Alternative 4 would keep about one-third of the Alternative 1 monitoring costs to track genetic results and root disease spread, for a cost of $2,000 per year. Alternative 5 would retain about 15 percent of the Alternative 1 costs for tracking root disease spread, or about $1,000 per year.

Additional Costs for Port-Orford-Cedar Mitigation Measures During Fire Suppression. While the increase in Biscuit Fire suppression costs attributable to POC mitigation practices (estimated $1.5 million) is indicative of a direct program cost applicable to Alternatives 1, 2, and 3, it is very difficult to estimate this type of unplanned event on an annual cost basis. The Biscuit Fire burned 29 percent of the POC range in a single year. The Fire and Fuels section of the "Draft SEIS To Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines" (USDA and USDI 2003) predicted 113,000 acres of wildfire within the range of the northern spotted owl. Although the POC range includes some of the most fire-prone portions of the owl range, the proportion of the 113,000 acres attributable to the POC range cannot exceed 15 to 20 percent. Such a relationship would suggest fire-related root disease mitigation costs might be in the neighborhood of $30,000 to $40,000 per year. Basing such numbers on the Biscuit Fire, however, is not representative. As noted in the fire section, fires that are extinguished during initial attack have few costs attributable to POC mitigation. On the other hand, the Biscuit Fire was so large as to generate economies of scale; mid-size fires would experience a higher percentage of suppression costs going to POC mitigation. A reasonable prediction is tens of thousands of dollars per year applicable to Alternatives 1, 2, and 3.

Costs May Vary by Year. While annual costs are projected over a 10-year horizon, individual category expenditures may vary over the period. Some category costs will be higher at the beginning of implementation, while becoming lower at the end of the 10-year period. Under Alternative 4, resistance breeding is a category where annual program costs would began at $515,000 in 2004, declining to $474,000 in 2008, and then settling to $413,000 in 2013. And, because under this alternative its overall costs are accelerated but not actually increased, Alternative 4 resistance breeding costs in the second decade will drop dramatically as compared to the other alternatives.

Other cost categories shown in Table 3&4-25 may vary from year-to-year also, but are anticipated to remain on a relatively even-flow over 10 years. While cost estimations were for a 10-year timeframe, it is not implied that POC program costs for any of the alternatives would stop at the end of the decade.

Environmental Justice

Affected Environment

Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, February 11, 1994) requires that all Federal agencies

> . . . make achieving Environmental Justice part of [their] mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.

Potential effects on minority groups, low income, and subsistence populations are to be addressed. Potential effects on American Indians are covered in Chapter 3&4, Culturally Significant Products for American Indian Tribes section. Race, class, occupational classifications, and immigration policies influence people's environmental perceptions, encounters, and experiences (Taylor 2002).

Racial Background

Illustrating this point, many nontimber forest workers involved in the collection of POC forest products as well as other special forest products originally came from other countries, such as Canada, Mexico, Guatemala, Honduras, and El Salvador in the Americas; and Laos and Cambodia in Southeast Asia (Brown and Marin-Hernandez 2000). While personally interested at many levels to natural resource management issues, many of these groups of people may also have linguistic, institutional, cultural, economic, or historic barriers to actively participating in public planning processes (Frewing-Runyon 1999).

Ten counties within the states of Oregon and California encompass the natural range of POC. Racial composition of the people that live within these counties is shown on Table 3&4-26.

Wages and Employment

While over 76 million new jobs were created in the last 30 years in the United States, the manufacturing sector of the economy that includes forest products has declined from nearly 22 percent of all jobs to less than 12 percent. Within the range of POC, county employment levels have reflected this trend—manufacturing sector jobs in Del Norte County, in northern California, for example, decreased from 25.1 percent in 1970, to 4.3 percent in 2000. While higher-paying manufacturing jobs became replaced by generally lower-paying services-related jobs, average annual earnings in these counties have declined (see Table 3&4-27). Compounding the effects of the lower personal incomes has been flat-to-rising unemployment rates. On a relative basis, every county unemployment rate is higher than both the State and national averages.

Effects of the Alternatives

This SEIS supplements EISs for the land and resource management plans of the three BLM districts and the Siskiyou NF, and the Environmental Justice discussion and consequences therein. These previous documents analyzed the effects of related management actions including human health, economic, and social effects.

The potential of the alternatives to affect American Indians was identified as an issue in this SEIS, and is addressed in the Tribal effects section earlier in this chapter. Tribal input was specifically sought during scoping and during analysis of effects of the alternatives.

There is high participation by minority and low-income populations in collecting special

Table 3&4-26.—Demographic statistics within the Oregon portion of the range of Port-Orford-cedar (2000 Census)

Table 3&4-27.—Average earnings and unemployment rate for the Oregon counties within the range of POC

forest products. Permits for collecting boughs will be severely restricted in Alternatives 1, 2, and 3 (similar to current direction). Permits, both commercial and personal use, for wild plants, mosses, bark, roots, mushrooms, firewood, and others could be reduced from current levels under Alternatives 2 and 3 (as described in the Special Forest Products effects section in this chapter), depending upon the results of analysis under the POC Risk Key. Such permits would also be reduced under Alternative 3 by restrictions in the POC core and buffers for the 32 uninfested watershed featured in this alternative. Under this alternative, it is expected that special forest products permits would be reduced by less than 5%, and therefore, would not have much affect. Conversely, Alternatives 4 and 5 will markedly increase special forest products harvest levels. These potential impacts to Environmental Justice are less than current under Alternatives 4 and 5, and slightly more than current under Alternatives 2 and 3.

Alternative 3 would result in a PSQ reduction of 0.7 million board feet per year, or about eight full-time jobs directly in the logging and milling industry. As part of Alternative 4, direct employment will increase by the equivalent of approximately eight full-time jobs resulting from an expanded special forest products program. No other Environmental Justice effects are identified.

Civil Rights Impact Assessment

Introduction

The Civil Rights Impact Assessment examines whether the alternatives identified in the draft SEIS may result in an adverse or disparate effect to additional groups of people beyond those considered by the Environmental Justice section. In accordance with USDA Departmental Regulation Number 4300-4, these additional groups or classes include:

Race, Color, National Origin	Age
Disability	Gender
Marital, Familial, Parental Status	Religion
Sexual Orientation	Genetics
Political Beliefs	Income from Public Assistance

It is assumed that these populations of people will continue to use or enjoy Federal forest lands for diverse purposes (such as recreation, hunting, and employment) and may be interested in, or potentially affected by, the proposed alternative.

Because this proposed alternative will result in a notice to be published in the *Federal Register*, this Civil Rights Impact Analysis has been prepared in accordance with Interim Use Departmental Directive (DR) 4300-4, Section 9.a.(1).

Demographic Information

Consistent with Council on Environmental Quality guidelines for determining affected environment for Environmental Justice (Council on Environmental Quality, Environmental Justice Guidance under the National Environmental Policy Act, December 10, 1997, section III.C.3), three maps were examined (see file copy of draft assessment) that describe specific racial groups (African American, Asian Pacific Islander, and Hispanic) living within the area of both the natural range of POC and the ten counties covered by the range of POC, five in Oregon and five in California. A fourth map was also examined, identifying population levels of people with disabilities (mobility disability for ages 16 to 64). Information on the other groups is either not available or too generalized to be useful for evaluation.

Analysis of the maps shows that the identified ethnic and disabled populations are present or in areas adjacent to the natural range of POC, but do not live evenly throughout this area. People with disabilities, for example, are generally congregated along the Interstate 5 highway corridor. The analysis area covers both metropolitan areas with diverse populations and economies, and rural areas with lower population densities in general, and lower population levels of minorities and disabled persons specifically.

Alternatives Considered

Alternative 1

This alternative would maintain the existing language in the Coos Bay, Roseburg, and Medford BLM District RMP/EISs and the Siskiyou NF EIS that described the range of social impacts of the existing POC program. No additional civil rights impacts are expected to accrue from maintaining the existing direction.

Alternatives 2 and 3

Hispanic and some Asian populations tend to be disproportionately involved with the collection of special forest products from Federal lands within the natural range of POC. No reduction in collection of POC boughs is anticipated under this alternative, but a slight decrease of less than 5 percent of other special forest products is predicted, and therefore, a slight adverse economic impact on these groups of people is anticipated. No mitigations for this effect have been identified.

Alternative 4 and 5

The analysis shows no additional adverse effects beyond Alternative 1, in terms of adverse civil rights impacts, are expected from implementing any of these three alternatives. Beneficial effects can be expected for groups involved with bough collecting, as levels of special forest products permitting dramatically increase.

Conclusion and Findings

This document has identified the demographic composition of the affected area; the types of potential impacts, if any, resulting from the alternatives; current information from scoping; and potential adverse or disparate impacts as they relate to groups of people identified in civil rights legislation.

Other than some slight potentially adverse economic effects to Hispanic and Asian populations as described above, no other adverse or disparate effects to the additional groups or classes of people are expected. The proposed action detailed in the draft SEIS is anticipated to comply fully with all applicable civil rights statutes, including Title VI of the "Civil Rights Act" of 1964.

Critical Elements of the Human Environment

Table 3&4-28 addresses the critical elements of the human environment.

Other Environmental Consequences

When considering the overall environmental impacts of this proposal, it is important to remember that this SEIS supplements the Siskiyou land and resource management plan SEIS that has been amended by the Northwest Forest Plan SEIS (USDA and USDI 1994a) and the Survey and Manage SEIS (USDA and USDI 2000). This SEIS also supplements the SEIS for the land management plans for the Coos Bay, Medford, and Roseburg BLM Districts which themselves incorporated the Northwest Forest Plan SEIS (USDA and USDI 1994a) and were subsequently amended by the Survey and Manage SEIS (USDA and USDI 2000). The Northwest Forest Plan final SEIS addressed issues and environmental impacts dealing with the full range of multiple-uses on Federal lands and led to sweeping decisions regarding timber management and resource conservation. The Survey and Manage Final SEIS was narrowly focused on issues concerning implementation of the Survey and Manage Standards and Guidelines. This SEIS is narrowly focused on the management practices and mitigation measures for the management of POC and its root disease. This SEIS only addresses management of POC and does not change the fundamental decisions or substantially change environmental impacts disclosed in the previous impact statements.

Table 3&4-28.– Critical elements of the human environment

The Council on Environmental Quality regulations require that the discussion of environmental consequences include

> . . . any adverse environmental effects which cannot be avoided should the proposal be implemented, the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented (40 CFR 1502.16).

Adverse Environmental Effects Which Cannot Be Avoided

An agency does not have to avoid adverse effects, but must identify and disclose any adverse environmental, social, and economic effects in the impact statement. This SEIS attempts to describe all identifiable adverse effects caused by the alternatives herein. Adverse effects which cannot be avoided include the continued spread of POC root disease at some level. Because the introduced disease is virulent and is spread by vectors such as elk and water, no mitigation could be proposed that could completely stop the POC mortality. At least some of the alternatives seek to mitigate that mortality through an active resistance breeding program.

Relationship Between Short-term Uses of the Human Environment and Maintenance of Long-term Productivity

The Agencies' land and resource management plans, as amended by the Northwest Forest Plan, committed NF System- and BLM-administered lands to multiple-use, including commercial timber commodity production. The environmental analyses supporting those plans determined that the loss in long-term productivity of forest soils and other components necessary for a healthy forest environment would be minimal. The alternatives explored in this SEIS are projected to have little relative additional effect on soil productivity. Slight effects are discussed in the Ultramafic Soils and the Water and Fisheries sections

Irreversible or Irretrievable Impacts

Irreversible refers to a loss of nonrenewable resources, such as mineral extraction, heritage (cultural) resources, or to those factors which are renewable over long time-spans, such as soil productivity. Irretrievable commitment applies to losses that are temporary, such as loss of forage production in an area being used as a ski run or use of renewable natural resources.

Since POC will clearly not be extirpated from any significant portion of its range, nor is it likely to lose any significant genetic variability, there will be no irreversible or irretrievable impacts.

Conflicts with Other Plans

The CEQ regulations (40 CFR 1502.16) require a discussion of

> . . . possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian Tribe) land use plans, policies and controls for the area concerned.

This SEIS incorporates by reference the discussions in the underlying land and resource management plans as amended, and nothing in this SEIS would alter the conclusions in those plans regarding the possible conflicts with other plans.

The management direction in this SEIS applies only to federally-managed lands where state and local land use plans, policies, and controls have little application. Similarly, the alternatives in this SEIS do not apply to Tribal and Indian-owned lands, with one exception. The Coquille Indian Tribe currently manages approximately 5,400 acres of forest lands (Coquille Forest) under the same standards and guidelines as the adjacent Federal land management agency (Coos Bay BLM District).

Western states have raised concerns about the occurrence of catastrophic wildfires in recent years, which led to formation of the National Fire Plan, a national multi-agency policy designed to prevent catastrophic wildfires through broad-scale fuel treatment and improved suppression efforts. The National Fire Plan proposes aggressive hazardous fuels abatement activities around communities and at-risk landscapes. The 2002 fire season was particularly problematic within the range of POC. Some of the harvest prohibitions in Alternative 3 could directly affect the Agencies' ability to meet their hazardous fuels treatment commitments around communities in the wildland/urban interface. The other alternatives do not have such restrictions.

Chapter 5 — Preparers, References, Glossary, and Index

Preparers

Port-Orford-Cedar-SEIS Core Team

Frank Betlejewski: *FS Port-Orford-Cedar Program Manager.* B.S., Natural Resource Management, Rutgers University; graduate of the Silviculture Institute. Frank has 24 years of Federal service; most of his career has been as a forester and silviculturist with the BLM in Medford, Oregon. He has also served as Medford District Pacific Yew Specialist and as the Applegate Adaptive Management Area Coordinator. Frank is the author of the "BLM Port-Orford-Cedar Management Guidelines" and has provided technical guidance for managing POC since 1990.

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John Kliejunas: *Regional Forest Pathologist, Pacific Southwest Region*. M.S., Forestry, University of Minnesota; Ph.D., Plant Pathology, University of Wisconsin, Madison. John has 7 years of experience with *Phytophthora* in Hawaii forest ecosystems, authoring numerous publications on *P. cinnamomi* and native forest decline. He has been on the Forest Health Protection staff in Region 5 since 1979 and has served as acting Forest Health Protection Program Leader. He is one of the original members of the interregional Port-Orford-cedar coordinating group, and has worked with *Phytophthora lateralis* for the last 23 years. John is a member of the American Phytopathological Society and the USDA-FS Wood Import Pest Risk Assessment Team.

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References

Ainsworth, G.C. 1971. Ainsworth and Bisby's Dictionary of the Fungi. Commonwealth Mycological Institute, Kew, Surrey. 663 p.

Anonymous. 1994. Port-Orford-Cedar and the Convention on International Trade in Endangered Species, Appendix II report. 26 p. [And] cover letter to Chief, USDA-FS from J.E. Lowe, Region 6 Regional Forester, R.E. Stewart, Region 5 Regional Forester, and C.W. Philpot, Pacific Northwest Station Director, March 3. 2 p.

Atzet, T.; White, D.E.; McCrimmon, L.A.; [and others] 1996. Field Guide to the Forested Plant Associations of Southwest Oregon. R6-NR-ECOL-TP-17-96, USDA-FS, Pacific Northwest Region, Portland, OR. 353 p.

Azuma, D.L.; Bednar, L.F.; Histerote, B.A.; [and others]. 2002. Timber Resource Statistics for Western Oregon, 1997. Resource Bulletin PNW-RB-237, USDA-FS Pacific Northwest Research Station.

Bartnicki-Garcia; Tsao, P.H., *eds*. *Phytophthora*: Its Biology, Taxonomy, Ecology, and Pathology. American Phytopathological Society, St. Paul, Minnesota. p. 95–107.

Beakes, G.W. 1987. Oomycete Phylogeny: Ultrastructural Perspectives. *In:* Rayner, A.D.M.; Braiser, C.M.; Moore, D.; *eds:* Evolutionary Biology of the Fungi. Cambridge University Press. p. 405–421.

Beckham, S. 1971. Requiem for a People: The Rogue Indians and the Frontiersmen. University of Oklahoma Press, Norman.

Beschta, R.L.; Bilby, R.; Brown, G.; [and others]. 1987. Stream Temperature and Aquatic Habitat: Fisheries and Forestry Interactions. *In:* Salo, E.O.; Cundy, T.W.; *eds.;* Streamside Management, Forestry and Fishery Interactions. Contribution No. 57:191–232, Institute of Forest Resources, University of Washington, Seattle.

Betlejewski, F. 1994. Port-Orford-Cedar Management Guidelines. USDI-BLM. 32 p.

Bjornn, T.C.; Reiser, D.W. 1991. Habitat Requirements of Salmonids in Streams. *In:* Meehan, W.R., *ed.* 1991. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Publication 19, Bethesda, MD.

Bower, A.D.; Casavan, K.; Frank, C.; Goheen, D.; [and others]. 2000. Screening Port-Orford-Cedar for Resistance to *Phytophthora lateralis*: Results from 7,000+ Trees Using a Branch Lesion Test. *In* Hansen and Sutton, *eds:* Proceedings From the First International Meeting on *Phytophthoras* in Forest and Wildland Ecosystems. IUFRO Working Party 7.02.09, Forest Research Laboratory, Oregon State University. p. 99–100.

Boyd, M. 1996. Heat Source: Stream Temperature Prediction. M.S. Thesis. Departments of Civil and Bioresource Engineering, Oregon State University, Corvallis, OR.

Brattain, D.; Stuntzer, R.E. 1994. Port-Orford-Cedar Alliance: Response to ONRC's Proposal to List Port-Orford-Cedar.

Brooks, A.S.; Seegert, G.L. 1977. Effects of Intermittent Chlorination on Rainbow Trout and Yellow Perch. American Fisheries Society Transactions 106(3). 278 p.

Brown, B.A.; Marin-Hernandez; *eds.* 2000. Voices from the Woods. Jefferson Center for Education and Research, 51 p.

Brown, G.W. 1969. Predicting Temperatures of Small Streams. Water Resources Research 5(1):68–75.

Burns, R.M.; Honkala, B.H., *tech. coords*. 1990. Silvics of North America. USDA-FS Agriculture Handbook 654. 877 p.

Burroughs, E. R. Jr.; Thomas, B.R. 1977. Declining Root Strength in Douglas-fir After Felling as a Factor in Slope Stability. USDA-FS, Intermountain Forest and Range Experiment Station Research Paper INT: 90.

California Employment Development. 1999. Monthly Labor Force Data for Counties, December 1998 (preliminary); 1997 Benchmark.

Carlile, M.J. 1983. Motility, Taxis, and Tropism in *Phytophthora*. *In:* Erwin; Bartnicki Garcia, S.; Tsao, P.H.; *eds*. *Phytophthora*: Its Biology, Taxonomy, Ecology, and Pathology. American Phytopathological Society Press. p. 95–107.

Cavalier-Smith, T. 1986. The Kingdom Chromista: Origin and Systematics. *In:* Round, I.; Chapman, D.J.; *eds.* Progress in Phycological Research (4). Biopress, Bristol, England. 481 p.

Chappell, C.B.; Crawford, R.C.; Barrett, C.; [and others]. 2002. Wildlife Habitats: Descriptions, Status, Trends, and System Dynamics. *In:* Johnson, D.H.; O'Neal, T.A. 2002. Wildlife-Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis.

Cooray, L.J.M. 1985. Chapter 11: Risk Avoidance, Freedom of Choice or Government Coercion. *In:* Human Rights in Australia, ACFR Educational Publications, Sydney, Australia.

Council on Environmental Quality. 1997. Environmental Justice — Guidance Under the National Environmental Policy Act. 34 p.

Daniel, T.W.; Helms, J.A.; and Baker, F.S. 1979. Principals of Silviculture. McGraw-Hill Publishing Company. 500 p.

DeNitto, G.; Kliejunas; J.T. 1991. First Report of *Phytophthora lateralis* on Pacific yew. (Abstract) Plant Disease 75:968.

Dick, M.W. 1982. Oomycetes. *In:* Parker, I.S.P., *ed.* Synopsis and Classification of Living

Organisms. McGraw-Hill Book Company, New York, NY. p. 179–180.

Dick, M.W. 1995. Sexual Reproduction in the Peronosporales (*Chromistan* fungi). Canadian Journal of Botany 73:5712–5724.

Dillingham, C. 2003. Ecologist, Vegetation Management Solutions, USDA-FS Enterprise Team.

Edwards, S.W. 1983. Cenozoic History of Alaskan and Port-Orford-(*Chamaecyparis*) Cedars. Ph.D. Dissertation. University of California, Berkeley. 271 p.

Edwards, S.W. 1985. The Remarkable Range of Port-Orford-Cedar. Four Seasons 7(3):4–15.

Elliott, L.J.; Sniezko, R.A. 2000. Cone and Seed Production in a Port-Orford-Cedar Containerized Orchard. *In:* Hansen and Sutton, *eds.*, Proceedings From the First International Meeting on *Phytophthoras* in Forest and Wildland Ecosystems. IUFRO Working Party 7.02.09. Forest Research Laboratory, Oregon State University. p. 105–106.

Erwin, D.C.; Ribeiro, O.K. 1996. *Phytophthora* Diseases Worldwide. American Phytopathological Society, Saint Paul, MN. 562 p.

Falconer, D.S. 1989. Introduction to Quantitative Genetics. Third edition. John Wiley & Sons, New York, NY.

Filip, G.M.; Kanaskie, A.; Campbell, A. III. 1995. Forest Disease Ecology and Management in Oregon. Oregon State University Extension Service. 60 p.

Fogg, J. 2003. Surface Water Modeling Specialist-Hydrologist. *Personnel Communication.* USDI-BLM, National Science Technical Center, Branch of Science Applications, ST-132.

Foster, C. 2003. District Wildlife Biologist. *Personnel Communication.* Roseburg BLM District, Roseburg, OR.

Frankham, R.; Ballou, J.D.; Briscoe, D.A. 2002. Introduction to Conservation Genetics. Cambridge University Press, New York, NY. p.19; 309.

Franklin, J.F.; Dryness, C.T. 1973. Natural Vegetation of Oregon and Washington. USDA-FS PNW-GTR-8, Portland, OR.

Frewing-Runyon, L. 1999. Environmental Justice Screening in NEPA Analysis for Oregon, Washington, and Northern California. USDI-BLM, Portland, OR. 17 p.

Goheen, D. J. 2003. Pathologist-entomologist: *Personnel Communication.* USDA-FS, Region 6, Southwest Oregon Forest Insect and Disease Service Center, Central Point, OR.

Goheen, D.; Angwin, P.; Sniezko, R.; [and others]. 2000. Port-Orford-Cedar Root Disease in Southwestern Oregon and Northwestern California. *In:* Hansen and Sutton, *eds.*, Proceedings of the First International Meeting on *Phytophthora* in Forest and Wildland

Ecosystems, IUFRO Working Party 7.02.09, Forest Research Laboratory, Oregon State University. p. 107–111.

Goheen, E.M.; Cobb, D.F.; Forry, K. 1986. Survey of the Coquille River Falls Research Natural Area. Unpublished report. USDA-FS, Forest Pest Management, Pacific Northwest Region. 10 p.

Goheen, E.M.; Cobb, D.F.; Forry, K. 1986. Roadside Surveys for Port-Orford-Cedar Root Disease on the Powers Ranger District, Siskiyou National Forest. Unpublished report. USDA-FS, Forest Pest Management, Pacific Northwest Region. 19 p.

Goheen, D.J.; Marshall; K.; Hansen, E.M.; [and others]. 1997. Port-Orford-Cedar Root Disease: Ecological Implications and Management. *In:* Beigel, J.K.; Jules, E.S.; Snitkin, B.; *eds.;* Proceedings of the First Conference on Siskiyou Ecology. Siskiyou Regional Educational Project. p. 189.

Goheen, D.J.; Marshall, K.; Hansen, E.M.; [and others]. 2000. Effectiveness of Vehicle Washing in Decreasing *Phytophthora lateralis* Inoculum: A Case Study. USDA-FS, SWOFIDSC-00-2. 7 p.

Goheen, D.J.; McWilliams, M.G.; Angwin, P.A.; [and others]. 2003. *Phytophthora lateralis* and Other Agents that Damage Port-Orford-Cedar. *In*: Range-wide assessment of Port-Orford-Cedar (*Chamaecyparis lawsoniana*) on Federal Lands. Chapter 3. [*In press*]

Gordon, D.E. 1974. The Importance of Root Grafting in the Spread of *Phytophthora* Root Rot in an Immature Stand of Port-Orford-Cedar. M.S. Thesis, Oregon State University, Corvallis. 116 p.

Gordon, D.E.; Roth, L.F. 1976. Root Grafting in Port-Orford-Cedar: An Infection Route for Root Rot. Forest Science 22:276–278.

Green, F. 2003. Westbrook Exports, Coos Bay, OR.

Hadfield, J.S.; Goheen, D.J.; Filip, G.M.; [and others]. 1986. Root Diseases in Oregon and Washington Conifers. R6-FPM-250-86, USDA-FS, Pacific Northwest Region. 27 p.

Hamm, P.B.; Hansen, E.M. 1984. Improved Method for Isolating *Phytophthora lateralis* from Soil. Plant Disease 68:517–519.

Hansen, E.M. 1993. Roadside Surveys for Port-Orford-Cedar Root Disease on the Powers Ranger District, Siskiyou National Forest. Unpublished report. Oregon State University, Corvallis. 17 p.

Hansen, E.M. 2000a. Final Report on New Tools for the Detection of *Phytophthora lateralis*. Unpublished report. Department of Botany and Plant Pathology, Oregon State University. 4 p.

Hansen, E.M. 2000b. Final Report on Demographics of Port-Orford-Cedar on Sites Infested with *P. lateralis* for Many Years. Unpublished report. Department of Botany and Plant

Pathology, Oregon State University, Corvallis. 5 p.

Hansen, E.M.; Hamm, P.B. 1983. Resistance Screening of Port-Orford-Cedar to *Phytophthora lateralis* Root Rot. Unpublished final report to USDA-FS, Region 6, Department of Botany and Plant Pathology, Oregon State University, Corvallis. 15 p.

Hansen, E. 1993. Roadside Surveys for Port-Orford-cedar Root Disease on the Powers Ranger District, Siskiyou National Forest.

Hansen, E.M.; Goheen; D.J.; Jules, E.S.; [and others]. 1999. Managing Port-Orford-Cedar and the Introduced Pathogen *Phytophtora lateralis*. Plant Disease 84(1):4–14.

Hansen, E.M.; Hamm, P.B. 1986. Screening Port-Orford-Cedar for Resistance to *Phytophthora lateralis*. Unpublished final report to USDA-FS, Region 6, Department of Botany and Plant Pathology, Oregon State University, Corvallis. 26 p.

Hansen, E.M.; Hamm, P.B.; Roth, L.F. 1989. Testing Port-Orford-Cedar for Resistance to *Phytophthora*. Plant Disease 73(10):791–794.

Hansen, E.M.; Hamm, P.B. 1996. Survival of *Phytophthora lateralis* in Infected Roots of Port-Orford-Cedar. Plant Disease 80:1075–1078.

Hansen, E.M.; Lewis, K.J. 1997. Compendium of Conifer Diseases. American Phytopathological Society. 101 p.

Hansen, E.M.; Streito, J.C.; Delator, C. 1999. First Confirmation of *Phytophthora lateralis* in Europe. Plant Disease 83:587.

Harvey, R.D.; Hadfield, J.H.; Greenup, M. 1985. Port-Orford-Cedar Root Rot on the Siskiyou National Forest in Oregon. USDA-FS, Pacific Northwest Region. 17 p.

Hawk, G.M. 1977. A Comparative Study of the Temperate Chamaecyparis Forests. Ph.D. Dissertation. Oregon State University, Corvallis, OR. 195 p.

Hedrick, P. W.; Gilpin, M.E. 1997. Genetic Effective Size of a Metapopulation. *In:* Hanski, I.; Gilpin, M.E., *eds*., Metapopulation Biology: Ecology, Genetics and Evolution. Academic Press, New York, NY. p. 165–181.

Heffner, K. 1984. Following the Smoke: Contemporary Plant Procurement by the Indians of Northwest California. Six Rivers National Forest, Eureka, CA.

Hendryx, M.; Hendryx, B.D. 1991. Plants and the People: The Ethnobotany of the Karuk Tribe. Siskiyou County Museum, Yreka, CA.

Henley, J.W. 1973. Port-Orford-Cedar: An AmericanWood. FS-228, USDA-FS.

Hepting, G.H. 1971. Diseases of Forest and Shade Trees of the United States. USDA-FS, Agriculture Handbook No. 386. 658 p.

Hoopa Tribal Forestry. 1994. Hoopa Valley Indian Reservation Forest Management Plan, Volume 1 for the Period 1994–2003. Hoopa Valley Tribe, Hoopa, CA.

Hyatt, T. L.; Naiman, R.J. 2001. The Residence Time of Large Woody Debris in the Queets River, Washington, USA. Ecological Applications 11(1):191–202.

IARC. 1991. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972–Present (Multivolume work). p. 52–173.

Jimerson, T.M. 1989. Snag Densities in Old-Growth Stands on the Gasquet Ranger District, Six Rivers National Forest, California. Research Paper PSW-196, Pacific Southwest Forest and Range Experiment Station, USDA-FS, Berkeley, CA. 12 p.

Jimerson, T.M. 1999. A Conservation Strategy for Port-Orford-Cedar. Unpublished paper.

Jimerson, T.M.; Creasy, R.M. 1991. Variation in Port-Orford-Cedar Plant Communities Along Environmental Gradients in Northwest California. *In:* Proceedings of the Symposium on Biodiversity of Northwestern California. Harris, R.R.; Erman, D.C.; Kerner, H.M.; *tech. coords*., [p. 122–133], University of California, Berkeley, CA. 308 p.

Jimerson, T.M.; Creasy, R.M. 1997. Series, Subseries and Plant Association Codes for Northwest California. USDA-FS, Six Rivers National Forest, Eureka, CA. 13 p.

Jimerson, T.M.; Daniel; S.L. 1994. A Field Guide to Port-Orford-Cedar Plant Associations in Northwest California. R5-ECOL-TP-002, USDA-FS, Pacific Southwest Region, San Francisco, CA. 154 p.

Jimerson, T.M.; Hoover, L.D.; McGee, E.A.; [and others]. 1995. A Field Guide to Serpentine Plant Associations and Sensitive Plants in Northwest California. R5-ECOL-TP-006, USDA-FS, Pacific Southwest Region, San Francisco, CA. 338 p.

Jimerson, T.M.; McGee, E.A.; DeNitto, G. 2000. A Supplement to: A Field Guide to Port-Orford-Cedar Plant Associations in Northwest California. R5-ECOL-TP-006, USDA-FS, Pacific Southwest Region, San Francisco, CA.

Jimerson, T.M.; McGee; E.A.; Jones, D.W.; [and others]. 1996. A Field Guide to the Tanoak and the Douglas-Fir Plant Associations in Northwest California. R5-ECOL-TP-009, USDA-FS, Pacific Southwest Region, San Francisco, CA. 546 p.

Johnson, D.H.; O'Neal, T.A.; *eds.* 2002. Wildlife-Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis. p. 736.

Jules, E.; Kaufmann, M. 1999. Reconstructing Historical Spread of *Phytophthora lateralis*: I. Patterns of Infection Between Populations of Port-Orford-Cedar. Presentation at rhe Ecology and Pathology of Port-Orford-Cedar: A Symposium [sponsored by USDA and USDI], Gold Beach, Oregon, July.

Jules, E. S.; Kauffman, M.J.; Ritts, W.D.; [and others]. 2002. Spread of an Invasive Pathogen Over a Variable Landscape: a Nonnative Root Rot on Port-Orford-Cedar. Ecology (83)11:3167–3181.

Kagan, J. 1990a. Draft Species Management Guide for *Epilobium oreganum* Greene. Developed for the Siskiyou NF and Medford BLM District, [on file at] Six Rivers NF Supervisor's Office, Eureka, CA.

Kagan, J. 1990b. Draft Species Management Guide for *Gentiana setigera* Wats. Developed for the Siskiyou NF and Medford BLM District, [on file at] Six Rivers NF Supervisor's Office, Eureka, CA.

Kagan, J. 1996. Draft Conservation Agreement for *Hastingsia bracteosa*, *H. atropurpurea*, *Gentiana setigera*, *Epilobium oreganum*, and *Viola primulifolia* var. *occidentalis* and Serpentine *Darlingtonia* Fens and Wetlands from Southwestern Oregon and Northwestern California, [on file at] Six Rivers NF Supervisor's Office, Eureka, CA.

Karuk Tribe of California. 1989. Karuk Ancestral Lands Forest Management Plan. Prepared for Klamath and Six Rivers NF [with technical assistance provided by Siskiyou Forestry Consultants, Arcata, CA], Karuk Tribe of California, Happy Camp, CA.

Kaufmann, M.; Jules, E. 1999. Reconstructing Historical Spread of *Phytophthora lateralis*: II. Infection Dynamics Along a Stream Population of Port-Orford-Cedar. Presentation at the Ecology and Pathology of Port-Orford-Cedar: A Symposium [sponsored by USDA and USDI], Gold Beach, OR, July.

Kitzmiller, J.H.; Sniezko, R.A. 2000. Range-Wide Genetic Variation in Port-Orford-Cedar (*Chamaecyparis lawsoniana* [A. Murr.] Parl.): I. Early Height Growth at Coastal and Inland Nurseries. Journal of Sustainable Forestry 10(1, 2). p 57–67.

Kitzmiller, J.; Sniezko, R.A.; Stevens, R.D.; [and others]. 2003. Genetics of Port-Orford-Cedar. *In:* Range-wide Assessment of Port-Orford-Cedar (*Chamaecyparis lawsoniana*), Chapter 5. [*In press*]

Kliejunas, J.T. 1994. Port-Orford-Cedar Root Disease. Fremontia 22:3–11.

Kliejunas, J.T.; Adams, D.H. 1980. An Evaluation of *Phytophthora* Root Rot of Port-Orford-Cedar in California. USDA-FS, Region 5, Forest Pest Management Report 80-1. 16 p.

Koepsell, P.A.; Pscheidt, J.W. 1994. Pacific Northwest Plant Disease Control Handbook. Oregon State University, Corvallis. 349 p.

Ledig, T. F. 1986. Conservation Strategies for Forest Gene Resources. Forests Ecology and Management 14:77–90.

Lewis, R.J. 1996. Sax's Dangerous Properties of Industrial Materials. 9th ed., Volumes 1–3. Van Nostran Reinhold, New York, NY.

Lienkaemper, G.W.; Swanson, F.J. 1987. Dynamics of Large Woody Debris in Streams in

Old-growth Douglas-fir Forests. USDA-FS, Pacific Northwest Research Station, Forest Sciences Laboratory General Technical Reprot PNW-69. 12 p.

Linhart, Y.B. 1995. Restoration, Revegetation, and the Importance of Genetic and Evolutionary Perspectives. *In:* Roundy, B.A.; et al., *comps*. Proceedings: Wildland Shrub and Arid Land Restoration Symposium, October 19-21, 1993, Las Vegas, NV., USDA-Forest Service, Intermountain Research Station General Technical Report INT-GTR-315, Ogden, UT.

Marshall, K.; Goheen, D.J. 2000. Preliminary Results of Effectiveness Monitoring of Port-Orford-Cedar Roadside Sanitation Treatments in Southwest Oregon. Unpublished report. Southwest Oregon Forest Insect and Disease Service Center, 2 p.

Martin, I.D.; Mackie, G.L.; Baker, M.A. 1993. Control of Biofouling Mollusk, *Dreissena polymorpha* (Bivalvia: Dreissenidae), with Sodium Hypochlorite and with Polyquarternary Ammonia and Benzothiazole Compounds. Archives Environmental Contamination and Toxicology 24(3):381–388.

McDade, M.H.; Swanson, F.J.; Franklin, J.F.; [and others]. 1990. Source Distances for Coarse Woody Debris Entering Small Streams in Western Oregon and Washington. Canada Journal of Forestry Resources 20:326–330.

McDonald, B.A.; Linde, C. 2002. Pathogen Population Genetics, Evolutionary Potential, and Durable Resistance. Annual Review of Phytopathology 40:349–379.

McNab, H.W.; Avers, P.E.; *comps*. 1994. Ecological Subregions of the United States: Section Descriptions. Administrative Publication WO-WSA-5, USDA-FS, Washington, D.C. 267 p.

McWilliams, M.G. 2000a. Port-Orford-Cedar and *Phytophthora lateralis*: Grafting and Heritability of Resistance in the Host and Variation in the Pathogen. Ph.D. Dissertation, Oregon State University, Corvallis.

McWilliams, M.G. 2000b. Variation in *Phytophthora lateralis*. *In:* Hansen and Sutton, *eds*., Proceedings of the First International Meeting on *Phytophthoras* in Forest and Wildland Ecosystems, IUFRO Working Party 7.02.09, Forest Research Laboratory, Oregon State University, Corvallis. p. 50–55.

Meehan, W.R., *ed.* 1991. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Publication 19, Bethesda, MD.

Merkel, Hermann W. 1905. A Deadly Fungus on the American Chestnut. N.Y. Zoological Society, 10th Annual Report. p. 97–103.

Miles, S.R.; Goudey, C.B.; *comps.* 1997. Ecological Subregions of California. R5-EM-TP-005, USDA-FS, Pacific Southwest Region, San Francisco, CA. 233 p.

Millar, C.I.; Marshall, K.A. 1991. Allozyme Variation of Port-Orford-Cedar (*Chamaecyparis lawsoniana*): Implications ror Genetic Conservation. Forest Science

37(4):1060–1077.

Millar, C. I.; Delaney, D.L.; Westfall, R.D. 1992. Genetic Diversity in Port-Orford-Cedar: Rangewide Allozyme Study. Summary Report, August 22, USDA-FS, Pacific Southwest Forest and Range Experiment Station, Berkeley, CA. 4 p.

Millar, C.I.; Delany, D.L.; Westfall, R.D.; [and others]. 1991a. Ecological Factors as Indicators of Genetic Diversity in Port-Orford-Cedar: Applications to Genetic Conservation. Unpublished report. 3 p.

Millar, C.I.; Delaney, D.L.; Westfall, R.D.; [and others]. 1991b. Ecological Factors as Indicators of Genetic Diversity in Port-Orford-Cedar: Application to Genetic Conservation, Internal Competitive Grants Program Progress Report, July 1, USDA-FS, Pacific Southwest Forest and Range Experiment Station, Berkeley, CA. 4 p.

Miller, R.C. 2003. Wildlife Technician, Illinois Valley Ranger District, Siskiyou NF.

Miller, T.; Kenetta, R. 1996. Confederated Tribes of Siletz.

Mills, S.D.; Foster, H.; Coffey, M.D. 1991. Taxonomic Structure of *Phytophthora cryptogea* and *P. drechsleri* Based on Isozyme and Mitochondrial DNA Analyses. Mycological Research 95:31–48.

Murray, M.S.; Hansen, E.M. 1997. Susceptibility of Pacific Yew to *Phytophthora lateralis.* Plant Disease 81:1400–1404.

Murray, M.S.; McWilliams, M.; Hansen, E.M. 1995. Survival of *Phytophthora lateralis* in Chlorine Bleach. Unpublished]. Oregon State University, Corvallis. 8 p.

Namkoong, G. 1979. Introduction to Quantitative Genetics In Forestry. USDA Technical Bulletin 1588. 308 p.

Namkoong, G.; Kang; H.C.; Brouard, J.S. 1988. Tree Breeding: Principles and Strategies. Springer-Verlag, New York, NY. 152 p.

National Fire Protection Association. 1986. Fire Protection Guide on Hazardous Materials. 9th ed. National Fire Protection Association, Boston, MA.

Nielsen, J. 1997. Port-Orford-Cedar: A Reasonable Risk for Reforestation (Under Specific Conditions). Northwest Woodlands 13:22–23.

Ollivier, L. 2003. Wildlife Biologist, USDA-FS, Pacific Southwest Research Station, Arcata, CA.

Oregon Natural Heritage Program. 2001. Rare, Threatened and Endangered Plants and Animals of Oregon. Oregon Natural Heritage Program, Portland, OR. 94 p.

Oregon State University. 1982. Average Dry-season Precipitation in Southwest Oregon, May Through September. Oregon State University Extension Service EM 8226, Corvallis, OR.

Ostrofsky, W.D.; Pratt, R.G.; Roth, L.F. 1977. Detection of *Phytophthora lateralis* in Soil Organic Matter and Factors that Affect Its Survival. Phytopathology 67:79–84.

Pacific Meridian Resources. 1996. Yurok Indian Reservation Forest Management Plan. Prepared for the Yurok Tribe, Eureka, CA.

Parks, C. 1993. SHADOW: Stream Temperature Management Program. User’s Manual v. 2.3. USDA-FS, Pacific Northwest Region.

Parker, I.S.P.; *ed*. 1982. Synopsis and Classification of Living Organisms. McGraw-Hill Book Company, New York, NY. 1,166 p.

Peattie, D.C. 1953. A Natural History of Western Trees. [From a scoping letter by] Umpqua Watersheds, Inc.

Priester, K. 1994. Words into Action: A Community Assesment of the Applegate Valley. Rogue Institute for Ecology and Economy. p. 68–69.

Priester, K. 1997. Public Issues Regarding the Scattered Apples Project in Williams, Oregon. 15 p.

Rogue Valley Council of Governments. 1996. Southwest Oregon Salmon Restoration Initiative, Phase 1: A Plan to Stabilize the Native Coho Population from Further Decline. Central Point, OR.

Rogue Valley Council of Governments. 1997. Southwest Oregon Salmon Restoration Initiative, Phase 1: A Plan to Stabilize the Native Steelhead Population in Southwest Oregon from Further Decline. Central Point, OR.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, CO.

Roth, L.E. 1985. Inoculation Methods for Quantitatively Evaluating the Response of Port Orford-Cedar Trees to *Phytophthora lateralis*. Unpublished report. 17 p.

Roth, L.F.; Bynum, H.H.; Nelson, E.E. 1972. *Phytophthora* Root Rot of Port-Orford-Cedar. USDA-FS, Forest Pest Leaflet 131. 7 p.

Roth, L.E.; Harvey, R.D. Jr.; Kliejunas, J.T. 1987. Port-Orford-Cedar Root Disease. USDA-FS R6 FPM-PR-294-87.

Roth, L.F.; Trione, E.J.; Ruhmann, W.H. 1957. *Phytophthora* Induced Root Rot of Native Port-Orford-Cedar. Journal of Forestry 55:294–298.

Scharpf, R.F.; *tech. coord*. 1993. Diseases of Pacific Coast Conifers. USDA-FS Agriculture Handbook 521. 199 p.

Shannon, M.; Sturdevant, V. 1995. Organizing for Innovation: A look at the Agencies and Organizations Responsible for Adaptive Management Areas: The Case of the Applegate AMA. Report submitted to the Interagency Liaison, USDA-FS and USDI-BLM.

Sharpe, J.M. 2002. Variation of Drought Resistance and Root Regeneration Among Genotypes of Port-Orford-Cedar (*Chamaecyparis lawsoniana*). M.S. Thesis. Oregon State University, Corvallis. 86 p.

Skinner, M.W.; Pavlik, M.; *eds*. 1994. California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California. Sacramento, CA.

Smith, D.M. 1962. The Practice of Silviculture. John Wiley and Sons, Inc. 578 p.

Sniezko, R.A.; Hansen, E.M. 2000a. Screening and Breeding Program for Genetic Resistance to *Phytophthora lateralis* in Port-Orford-Cedar (*Chamaecyparis lawsoniana*): Early Results. *In*: Hansen and Sutton, *eds*., Proceedings from the First International Meeting on *Phytophthoras* in Forest and Wildland Ecosystems. IUFRO Working Party 7.02.09, Forest Research Laboratory, Oregon State University, Corvallis. p. 91–94.

Sniezko, R.A.; Elliott, L.J.; Goheen, D.J.; [and others]. 2003a. Development of *Phytophthora lateralis* Resistant Port-Orford-Cedar for Restoration in the Pacific Northwest. *In:* Bassman, J.H.; Johnson, J.D.; Fins, L.; [and others], *eds*., Rocky Mountain Ecosystems: Diversity, Complexity and Interactions. Proceedings 17th North American Forest Biology Workshop, July 15-18, 2002, Washington State University Cooperative Extension, Pullman, WA. [*In press*]

Sniezko, R.A.; Hansen, E.M.; Bower A.; [and others]. 2000. Genetic Resistance of Port-Orford-Cedar (*Chamaecyparis lawsoniana*) to *Phytophthora laterlais*: Results From Early Field Trials. *In*: Hansen and Sutton, *eds*., Proceedings from the First International Meeting on *Phytophthoras* in Forest and Wildland Ecosystems. IUFRO Working Party 7.02.09, Forest Research Laboratory, Oregon State University, Corvallis. p. 138–140.

Sniezko, R.A.; Hansen, E.M.; Kitzmiller J.H; [and others]. 2000. Range-wide Genetic Variation in *Phytophthora lateralis* Resistance in *Chamaecyparis lawsoniana*. Unpublished manuscript.

Sniezko, R.A.; Kitzmiller, J.; Elliott, L.J.; [and others]. 2003b. Breeding for Resistance to *Phytophthora lateralis*. *In*: Range-wide Assessment of Port-Orford-Cedar (*Chamaecyparis lawsoniana*) on Federal Lands, Chapter 6. [*In press*]

Spelter, H.; McKeever, T. 2001. Profile 2001: Softwood Sawmills in the United States and Canada. Research Paper FPL-RP-594, USDA-FS Forest Products Laboratory.

Sproul, B. 2003. East Fork Lumber Co., Inc., Myrtle Point, OR.

Stern, K.; Roche, L. 1974. Genetics of Forest Ecosystems. Springer-Verlag, New York, NY. p. 228.

Strahler, A.N. 1957. Quantitative Analysis of Watershed Geomorphology. Transactions American Geophysics Union 38:913–920.

Stuntzer, R.E. 1991. Port-Orford-Cedar Study: A Report on the Socio-Economic Impacts of the Harvest of Port-Orford-Cedar.

Swingle, R.U.; Whitten, R.R.; Brewer, E.G. 1949. Dutch Elm Disease. *In:* Yearbook of Agriculture, USDA, U.S. Government Printing Office, Washington, D.C.

Tainter, F.H.; Baker, F.A. 1996. Principals of Forest Pathology. John Wiley and Sons, Inc. 805 p.

Taylor, D. E. 2002. Race, Class, Gender, and American Environmentalism. USDA-FS, General Technical Report PNW-GTR-534. 51 p.

Thies, W.G.; Goheen, E.M. 2003. Major Forest Diseases of the Oregon Coast Range and Their Management. Summary of the COPE Project. [*In press*]

Tomascheski, D. 2003. Sierra Pacific Industries, Anderson, CA.

Torgeson, D.C.; Young, R.A.; Milbrath, J.A. 1954. *Phytophthora* Root Rot Diseases of Lawson Cypress and Other Ornamentals. Oregon State College Agricultural Experiment Station Bulletin 537. 18 p.

Trione, E.J. 1959a. The Pathology of *Phytophthora lateralis* on Native *Chamaecyparus lawsoniana*. Contributions to the Boyce Thompson Institute 17: 359–373.

Trione, E.J. 1959b. The Pathology of *Phytophthora lateralis* on Native *Champaecyparis lawsoniana*. Phytophtology 49:306–310.

Trione, E.J. 1974. Sporulation and Germination of *Phytophthora lateralis*. Phytopathology 64:1531–1533.

Tucker, C.M.; Milbrath, J.A. 1942. Root Rot of *Chamaecyparis* Caused by a Species of *Phytophthora*. Mycologia 34:94–103.

Umaerus, V.; Umareus, M.; Erjefalt, L.; [and others]. 1983. Control of *Phytophthora* by Host Resistance: Problems and Progress. *In:* Erwin, D.C.; Bartnicki-Garcia, S.; Tsao, P.H.; *eds.* Phytophthora: Its Biology, Taxonomy, Ecology, and Pathology. American Phytopathological Society Press. p. 315–326.

U.S. Coast Guard, Department of Transportation. 1984. CHRIS - Hazardous Chemical Data. Volume II. U.S. Government Printing Office, Washington, D.C.

USDA. 1997. Ecological Subregions of California, Section and Subsection Descriptions. USDA-FS, Pacific Southwest Region, R5-EM-TP-005.

USDA-FS. 1965. Silvics of Forest Trees of the United States: Port-Orford-Cedar (*Chamaecyparis lawsoniana* (A. Murr.) Parl.). Agriculture Handbook No. 271: 157–160.

USDA-FS. 1969. California Tree Seed Zone Map (scale 1:5,000,000). USDA-FS, California Region, San Francisco, CA.

USDA-FS. 1973. Washington and Oregon Tree Seed Zone Maps (scale 1:5,000,000). USDA-FS, Pacific Northwest Region, Portland, OR.

USDA-FS. 1983. Forest Disease Management Notes. USDA-FS, Pacific Northwest Region, Government Printing Office. p 695–726.

USDA-FS. 1992. An Interim Guide to the Conservation and Management of Pacific Yew. USDA-FS, Pacific Northwest Region. 72 p.

USDA-FS. 1989. Siskiyou National Forest Land and Resource Management Plan. Siskiyou National Forest, Grants Pass, OR.

UDSA-FS. 1994. Port-Orford-Cedar Management Plan. Regions 5 and 6.

USDA-FS. 1994. Final Environmental Impact Statement, Dunes Management Plan, Oregon Dunes NRA, Siuslaw National Forest. Corvallis, OR.

USDA-FS. 1995a. Land and Resource Management Plan, Klamath National Forest. Yreka, CA.

USDA-FS. 1995b. Land and Resource Management Plan, Six Rivers National Forest. Eureka, CA.

USDA-FS. 1995c. Shasta-Trinity National Forest Land and Resource Management Plan. Vallejo, CA.

USDA-FS. 1998. Plant Associations of the Oregon Dunes National Recreation Area, Siuslaw National Forest, Oregon. Pacific Northwest Region Technical Paper R6-NR-ECOL-TP-09-98.

USDA-FS. 2002. Survey and Manage Species Summary of Recommendations Regarding Category Placement and Range Changes from the 2002 Annual Species Review.

USDA-FS. 2002. Interim Direction for the ROR/SIS National Forests: Best Management Practices For Noxious Weed Prevention and Management. Port-Orford-cedar Root Disease Prevention and Management.

USDA-FS; Oregon Department of Forestry. 2002. Forest Insect and Disease Highlights in Oregon, 2001. USDA-FS R6-NR-FID-TP-04-02, Portland, OR.

USDA-FS; USDI. 1994. Applegate Adaptive Management Area Ecosystem Health Assessment.

USDA-FS; USDI-BLM. 1985. Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington. USDA-FS Pacific Northwest Region, Portland, OR.

USDA-FS; USDI-BLM. 1994. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-successional and Old-growth Related Species Within the Range of the Northern Spotted Owl. Portland, OR. 322 p.

USDA-FS; USDI-BLM. 1994. Standards and Guidelines for Management of Habitat for Late Successional and Old-Growth Forest Related Species Within the Range of the

Northern Spotted Owl. Portland, OR.

USDA-FS; USDI-BLM. 1995. Southwest Oregon Late-Successional Reserve Assessment. 150 p.

USDA-FS; USDI-BLM. 1995a. Applegate River Watershed Assessment: Aquatic, Wildlife, and Special Plan Habitat.

USDA-FS; USDI-BLM. 1997. West Fork Watershed Analysis. [*In press*]

USDA-FS; USDI-BLM. 2000. Final Supplemental Environmental Impact Statement for Amendment to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines. Regional Ecosystem Office, Portland, OR.

USDA-FS; USDI-BLM. 2001. Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines. Portland, OR. p. 130+.

USDA-FS; USDI-BLM. 2003. Survey and Manage Species Summary of Recommendations Regarding Category Placement and Range Changes from the 2002 Annual Species Review.

USDA-FS; USDI-BLM. 2003. A Range-wide Assessment of Port-Orford-Cedar (*Chamaecyparis lawsoniana*) on Federal Lands. Oregon/Washington State Office, Portland, OR. [*In press*]

USDA-FS; USDI-FWS; USDC-NOAA-NMFS; [and others]; Forest Ecosystem Management Assessment Team. 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment.

USDI-BLM. 1995. Medford District Resource Management Plan. Medford, OR.

USDI-BLM. 1996. Williams Watershed Analysis. Medford, OR. 112 p.

USDI-BLM. 1996a [updated 2002]. Western Oregon Districts Transportation Management Plan. Oregon/Washington State Office, Portland, OR. 36 p.

USDI-BLM. 1998. Environmental Assessment for the Williams Port-Orford-Cedar Management Project. Medford, OR. 52 p.

USDI-BLM. 1995a. Coos Bay District Record of Decision and Resource Management Plan. Coos Bay District, North Bend, OR.

USDI-BLM. 1995b. Record of Decision and Resource Management Plan. Medford District, Medford, OR.

USDI-BLM. 1995c. Record of Decision and Resource Management Plan. Roseburg District, Roseburg, OR.

USDI-BLM. 2002. Transportation Management Plan: Western Oregon Districts.

USDI-BLM. 2003. West Fork Illinois River Watershed Assessment. Medford District, Medford, OR.

USDI-BLM; USDA-FS. 2000. East Fork Illinois River Watershed Analysis. Medford District Office, Medford, OR.

U.S. Environmental Protection Agency. 1984. Ambient Water Quality Criteria for Chlorine EPA-440/5-84-030. *Cited in*: Hermanutz, R.O.; Allen, K.N.; Hedtke. 1987. Toxicity and Fate of Total Residual Chlorine in Outdoor Experimentsal Streams. *In:* Water Chlorination: Chemistry, Environmental Impact and Health Effects. Proceedings of the Sixth Conference on Water Chlorination: Environmental Impacts and Health Effects, Volume 6. Lewis Publishers, Inc., Chelsea, MI. p. 463–477.

U.S. Environmental Protection Agency. 1986. Sodium/Calcium Hypochlorite (Clorox, bleach). Chemical Fact Sheet. 4 p.

U.S. Environmental Protection Agency. 1991. Sodium and Calcium Hypochlorite Salts. R.E.D. Facts.

U.S. Environmental Protection Agency. 1998. Ecoregions of Western Washington and Oregon. U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory Map (scale 1:1,350,000), Corvallis, OR.

Van Der Plank, J.E. 1975. Principles of Plant Infection. Academic Press, New York, San Francisco, London.

Waddell, K.L.; Bassett, P.M. 1996. Timber Resource Statistics for the North Coast Resource Area of California. Resource Bulletin PNW-RB-214, USDA-FS Pacific Northwest Research Station.

Waddell, K.L.; Bassett, P.M. 1997. Timber Resource Statistics for the North Interior Resource Area of California. Resource Bulletin PNW-RB-222, USDA-FS Pacific Northwest Research Station.

Warren, D.D. 1985. Production, Prices, Employment, and Trade in Northwest Forest Industries. USDA-FS, Pacific Northwest Research Station.

Warren, D.D. 1998. Production, Prices, Employment, and Trade in Northwest Forest Industries, Third Quarter 1997. PNW-RB-229, USDA-FS, Pacific Northwest Research Station. p. 30, 33, and 35.

Warren, D.D. 2002. Production, Prices, Employment, and Trade in Northwest Forest Industries, All Quarters of 2000. Resource Bulletin PNW-RB-236, USDA-FS Pacific Northwest Research Station.

Webb, L.O. 2003. Forest Wildlife Biologist. *Personnel Communication.* Rogue River and Siskiyou NFs, Grants Pass, OR.

Wemple, B.C.; Jones, J.A.; Grant, G.E. 1996 Channel Network Extension by Logging Roads in Two Basins, Western Cascades, Oregon. American Water Resources Association Water Resources Bullulletin 32(6).

Westfall, R.D. 1992. Developing Seed Transfer Zones. *In:* Fins, L.; et al. *eds*. Handbook of Quantitative Forest Genetics. Kluwer Academic Publishers, the Netherlands. p. 313–398.

Winton, L.M.; Hansen, E.M. 2000. PCR Diagnosis of *Phytophthora lateralis*. *In:* Hansen and Sutton, *eds.* Proceedings of the First International Meeting on Phytophthoras in Forest and Wildland Ecosystems. IUFRO Working Party 7.02.09, Forest research Laboratory, Oregon State University, Corvallis. p. 148–149.

Younker, J. 2003. Anthropologist, University of Oregon, Eugene.

Zobel, D.B. 1979. Seed Production in Forests of *Chamaecyparis lawsoniana*. Canadian Journal of Forest Resources 9:327–335.

Zobel, D.B. 1986. Port-Orford-Cedar: A Forgotten Species. Journal of Forest History 30: 29–36.

Zobel, D.B. 1990a. *Chamaecyparis lawsoniana* (A. Murr.) Parl., Port-Orford-Cedar. *In:* Silvics of North America, Volume 1, Conifers. USDA-FS Agricultural Handbook 654, Washington, D.C. p. 88–96.

Zobel, D.B. 1990b. Effects of Low Temperature, Seed Source, and Seed Age on Germination of *Chamaecypars lawsoniana*. Canadian Journal of Forest Resources 20:1053–1059.

Zobel, D.B.; Hawk, G.M. 1980. The Environment of *Chamaecyparis lawsoniana*. American Midland Naturalist 103(2):280–297.

Zobel, B. J.; Talbert, J.T. 1984. Applied Forest Tree Improvement. John Wiley & Sons, New York, NY. p. 274, 461.

Zobel, D.B.; Roth, L.F.; Hawk, G.M. 1985. Ecology, Pathology, and Management of Port-Orford-Cedar (*Chamaecyparis lawsoniana*). USDA-FS, Pacific Northwest Experiment Station General Technical Report PNW-184. 161 p.

Zobel, D.B.; Kitzmiller, J.; Sniezko, R.; [and others]. 2002. Range-wide Genetic Variation in Port-Orford-Cedar (*Cupressaceae, Chamaecyparis lawsoniana*): II. Timing of Height Growth. Journal of Sustainable Forestry 14: 33–49.

Zobel, D.B.; Kitzmiller, J.H.; Sniezko, R.A.; [and others]. 2003. Variation in Height Growth Phenology of Port-Orford-Cedar Seedlings. Journal of Sustainable Forestry. [*In press*]

Zobel, D.B.; Riley, L.; Kitzmiller, J.H. [and others]. 2001. Variations in Water Relations Characteristics of Terminal Shoots of Port-Orford-Cedar (*Chamaecyparis lawsoniana*) Seedlings. Tree Physiology 21:743–749.

References Online

http://jersey.uoregon.edu/~mstrick/AskGeoMan/geoQuerry23.html

http://jersey.uoregon.edu/~mstrick/GeoTours/Josephine%20Ophiolite/JoOphiolite.html

http://wwwga.usgs.gov/gis/iag.html

http://www.Sonoran.org [Sonoran Institute and USDI-BLM, Economic Profile System, (Tables and Graphs)]

http://www.fs.fed.us/r6/nr/fid/health/con-rpt-02.shtml

http://www.boe.ca.gov/proptaxes/pdf/caltimberharv 91-00.pdf [California State Board of Equalization, 1991–2001 California Timber Harvest by County]

http://www.odf.state.or.us/divisions/resource_policy/resource_planning/Annual_Reports [Oregon Department of Forestry Annual Western Oregon Harvest Reports, 1991–2001]

http://www.blandon.co.uk/forestry/species/hinoki.htm [2003, Japan’s Forest Industry]

Glossary

Acre ~ A land area measurement based on horizontal plane; 43,560 square feet; 1/640th of a square mile; approximately 0.4 hectares; if square, nearly 209 feet on a side.

Adaptive management ~ A continuing process of action-based planning, monitoring, researching, evaluating, and adjusting with the objective of improving implementation and achieving the goals of the standards and guidelines.

Adaptive Management Areas ~ Land allocation under the Northwest Forest Plan; areas designated for development and testing of technical and social approaches to achieving desired ecological, economic, and other social objectives.

Administratively Withdrawn Areas ~ Areas removed from the suitable timber base through agency direction and land management plans.

Allele frequency ~ Frequency of alleles in a population. An allele is one of a pair (in diploid individual) or series (in a population) of genes located at the same locus in homologous chromosomes and controlling the same character.

Allozyme ~ Refers to segregating electrophoretic variants of enzymes.

Alluvium ~ Stream sediments and organic materials moved and deposited by the action of flowing water.

Alternative ~ One of several policies, plans, or projects proposed for making decisions.

Amphibians ~ Cold-blooded vertebrates, including frogs, toads, salamanders, and newts, having four limbs and glandular skin, tied to moist or aquatic habitats for all or at least part of their life cycle.

Angular canopy density ~ The quality of shade, determined by the position of the sun during the day and the influence of vegetation blocking the incoming radiation.

Arcuate ~ Having the form of a bow; curved.

Autecology ~ The branch of ecology that deals with the biological relationship between an individual organism or an individual species and its environment.

Biological evaluation ~ A documented FS review of activities in sufficient detail to determine how an action or proposed action may affect any threatened, endangered, proposed, or sensitive species.

Biological diversity ~ The variety of life and its processes.

Breeding ~ The science or art of changing the genetic constitution of a population of plants or animals.

Breeding block ~ A breeding block designates the geographic area which envelops a number of breeding zones.

Breeding zone ~ A breeding zone designates a unit of land in which an improved population of a species is being developed. Progeny testing and/or breeding activity is conducted to obtain an "improved" population (for one or more traits of interest) over time. The boundaries of a breeding zone may or may not coincide with seed zones. In many instances, a breeding zone covers multiple seed zones.

Buffer ~ In Alternative 3, all lands within the 32 currently uninfested 6th field watersheds except stands containing POC (see Alternative 3, Chapter 2).

Bureau assessment species ~ Plant and animal species on List 2 of the Oregon Natural Heritage Data Base, or those species on the Oregon List of Sensitive Wildlife Species (OAR 635100040), which are identified in BLM Instruction Memo No. OR9157, and are not included as Federal candidate, state listed, or Bureau sensitive species.

Bureau sensitive species ~ Plant or animal species eligible for Federal listed, Federal candidate, state listed, or state candidate (plant) status, or on List 1 in the Oregon Natural Heritage Data Base, or approved for this category by the State Director.

Candidate species ~ Those plant and animal species that, in the opinion of the USFWS or NOAA-NMFS, may qualify for listing as endangered or threatened. The USFWS recognizes two categories of candidates: Category 1 candidates are taxa for which the USFWS has on file sufficient information to support proposals for listing; Category 2 candidates are taxa for which information available to the USFWS indicates that proposing to list is possibly appropriate, but for which sufficient data are not currently available to support proposed rules.

Canopy cover: See *percent cover.*

Chronic ~ Marked by long duration or frequent recurrence.

Channel morphology ~ The form and arrangement of stream channels in watersheds.

Checkerboard ~ The land ownership pattern derived from having granted railroad rights to every other section for many miles either side of proposed railroad lines.

Cline ~ A geographic gradient, which is often associated with adaptive genetic response to the gradients.

Clone ~ Group of identical genotypes propagated by traditional method of rooted cuttings. Rooted cuttings are used to establish a containerized seed orchard and for root dip resistance testing.

Coarse woody debris ~ Portion of a tree that has fallen or been cut and left in the woods. Usually refers to pieces at least 20 inches in diameter.

Common garden study ~ As the name implies, a common garden study is designed to compare variation patterns of a few to relatively large numbers of genetic identities (e.g., provenances, open-pollinated or controlled pollinated families, clones, etc.), all grown in at least one, but frequently several, uniform test sites, or “gardens”.

Compaction ~ See *soil compaction*.

Complete resistance (for POC) ~ POC seedlings or trees show no significant sign or symptom of infection after exposure to PL. In greenhouse root dip testing there is no visible sign of measurable root infection upon examining roots; in field tests tree survival is near expected levels and inconsistencies may be due to undetermined causes of mortality that occur. The underlying resistance mechanism(s) for complete resistance are unknown at this time, but preliminary analysis indicates this type of resistance shows major gene inheritance. The durability of complete resistance in POC will depend upon the particular type of resistance and attributes of the pathogen. There is no evidence to date of a virulent strain that overcomes complete resistance in POC. Normal infection is through the root tips, and it is possible that wounded roots would provide a different entry point for the pathogen.

Confined channel ~ A stream that is vertically contained, by incisement or hillslopes, and does not spread appreciably with increasing streamflow.

Congressionally Reserved Areas ~ Areas that require congressional enactment for their establishment, such as national parks, wild and scenic rivers, national recreation areas, national monuments, and wilderness. Also referred to as Congressional Reserves. Includes similar areas established by Executive order such as national monuments.

Conifer ~ Any of a group of needle and cone-bearing evergreen trees.

Conservation genetics ~ The use of genetics to preserve species as dynamic entities that can evolve to cope with environmental change and thus minimize their risk of extinction.

Conservation agreement ~ A formal written document agreed to by USFWS and/or NOAA-NMFS and another Federal agency, Tribe, state agency, local government, or the private sector to achieve the conservation of candidate species through voluntary cooperation. It documents the specific actions and responsibilities for which each party agrees to be accountable. The objective of a conservation agreement is to reduce threats to a candidate species and/or its habitat. An effective conservation agreement may lower listing priority or eliminate the need to list a species.

Core ~ In Alternative 3, stands with POC within the 32 currently uninfested 6th field watersheds (see Alternative 3, Chapter 2).

Cumulative effect ~ The impact which results from identified actions when they are added to other past, present, and reasonably foreseeable future actions regardless of who undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

Deme ~ a local group of interbreeding individuals.

Dendrochronology ~ A method of dating trees and natural events by examining the ages and ring patterns of forest trees and snags.

Disease ~ An abnormal, injurious physiological condition brought about by a continuous irritation. Plant disease usually involves a complex relationship between a susceptible host, a conducive environment, and a causal agent called a pathogen.

Disjunct stands or populations ~ Stands or populations of trees that are separated in location and are not contiguous.

Diurnal ~ Day to night change, as with temperature.

Duff ~ An organic surface soil layer below the litter layer in which the original form of plant and animal matter cannot be identified with the unaided eye.

Ecological amplitude ~ The breadth of the biological and environmental requirements of a species such as temperature, moisture, soil types, hosts, and stand ages.

Ecosystem approach ~ A strategy or plan to manage ecosystems to provide for all associated organisms, as opposed to a strategy or plan for managing individual species.

Effective population size ~ The number of individuals that would give rise to the calculated sampling variance, or rate of inbreeding, if they bred in the manner of the idealized population; where idealized population is defined as one in which mating is random, migration is excluded, no mutation, generations are distinct, and no selection applied.

Effects ~ *Effects*, *impacts*, and *consequences* are synonymous. Effects may be direct, indirect, or cumulative and may fall in one of these categories: aesthetic, historic, cultural, economic, social, health, or ecological (such as effects on natural resources and on the components, structures, and functioning of affected ecosystems).

Effects ~ Analysis of environmental consequences of a proposed action. Effects may be either *direct*, which are caused by the action and occur at the same time and place, *indirect*, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable, or *cumulative*.

Endangered species ~ Any plant or animal species in danger of extinction throughout all, or a significant portion of its range.

"Endangered Species Act" (ESA) ~ A law passed in 1973 to conserve species of wildlife and plants determined by the Director of the USFWS or the NOAA-NMFS to be endangered or threatened with extinction in all or a significant portion of its range. Among other measures, ESA requires all Federal agencies to conserve these species and consult with the USFWS or NOAA-Fisheries on Federal actions that may affect these species or their designated critical habitat.

Endemic or endemism ~ Unique to a specific locality or the condition of being unique to a specific locality.

Endemic ~ The population of potentially injurious plants, animals, or diseases that are at their normal balances level, in contrast to epidemic.

Environment ~ The aggregate of physical, biological, economic, and social factors affecting organisms in an area.

Environmental analysis (EA) ~ An analysis of alternative actions and their predictable short-term and long-term environmental effects, incorporating physical, biological, economic, and social considerations.

Environmental impact statement (EIS) ~ A statement of the environmental effects of a proposed action and alternatives to it required for major Federal actions under Section 102 of the NEPA, and released to the public and other agencies for comment and review. It is a formal document that must follow the requirements of NEPA, the Council on Environmental Quality guidelines, and directives of the agency responsible for the project proposal.

Ephemeral stream ~ A channel that only flows water during and shortly after storm events.

Epidemic ~ A disease outbreak.

Epidemiology ~ Factors affecting outbreak and spread of an infectious disease.

Evolution ~ Long-time changes in gene frequency and phenotypic characteristics of a population or group of populations.

Evolutionary force ~ Processes which change gene frequencies over time; usually referenced as mutation, migration, and selection.

Ex-situ conservation ~ Saving genes and genotypes offsite in the form of seed, clonal propagation, etc., in order to preserve the genetic material over time.

Federal candidate taxa ~ A classification category for those threatened, endangered, and sensitive plants or animals listed in the *Federal Register,* and other plants recommended for addition to the Federal candidate list.

Fen ~ A wetland of slow moving, often alkaline water with sedge (not sphagnum) peat underfoot.

Field water potential ~ An integration of the net effect of plant water relations' characteristics and their interaction with the environment. Often evaluated by inserting plant tissue into an enclosed chamber and measuring the amount of pressure (expressed in milli-pascals, or MPa) required to just begin to force moisture from the severed stem. Commonly assessed at pre-dawn, when the plants are least stressed by the environment and again at mid-day when stresses are usually higher.

Floodplain ~ That area, along stream channel margins, that can be inundated during flows that are greater than the normal channel dimensions; sometimes called the *floodprone* area.

Flora ~ Plants.

Fluvial erosion ~ The action of stream bank or bed removal by the forces of flowing water.

Forb ~ A herbaceous plant that is not a graminoid.

Forest Ecosystem Management Assessment Team (FEMAT) ~ An interagency, interdisciplinary team of scientists, economists, and sociologists led by Dr. Jack Ward Thomas and chartered to review proposals for management of Federal forests within the range of the northern spotted owl. The team produced a report assessing ten options in detail, which were used as a basis for developing the Northwest Forest Plan.

Founder effects ~ When a species colonizes a new area, the founding members are referred to as the founders of the new population. If the founding number of individuals are few, a substantial amount of genetic drift can occur.

Full-sibs ~ Trees with both parents in common.

Gene flow ~ The spread of genes through crossing.

Genecology ~ A combination of ecology and genetics.

Genetic drift ~ Change in gene frequency and population structure due to chance rather than by selection, and usually more pronounced in small populations.

Genetic structure ~ The relative pattern of genetic variation and differentiation among populations or segments of the genome. Change in genetic structure can be summarized by the changes in allele frequencies, heterozygosity, and genetic variances and covariances. Genetic variation/structure is most often measured indirectly by the use of molecular markers and quantitative genetic assessments. Changes in structure can be measured indirectly over time by the above methods, or can be inferred by population and quantitative genetics theory.

Graminoid ~ All grasses and grass-like plants, including sedges and rushes.

Ground-based logging system ~ Tractor or cable partial suspension (as opposed to cable full suspension or helicopter).

Growth phenology ~ The timing of periodic phenomena such as growth initiation, growth cessation, especially as related to seasonal changes in temperature, moisture, and photoperiod.

Habitat ~ The sum total of environmental conditions of a specific place occupied by a wildlife species or a population of such species.

Habitat type ~ An aggregation of all land areas potentially capable of producing similar plant communities at climax stage.

Half-sibs ~ Trees with one parent (usually the female) in common.

Headwaters ~ Uppermost contributing drainage area in a watershed; also refers to the start of visible streamflow in a channel.

Heterozygosity ~ A measure or reference to the amount of heterozygous condition of populations or species. The proportion of loci that are polymorphic (i.e., more than one form) among the loci tested. The average heterozygosity refers to the frequency of heterozygotes averaged over the loci tested.

Hierarchical model ~ One or more sampling units are represented within the experiment. The units are ordered and variation among the sampling units is assessed. The general ordering or listing of units is referred to as the hierarchy in the model formulation and subsequent statistical analysis.

High-risk site ~ Low-lying wet areas (infected or not) that are located downslope from already infected areas or below likely sites for future introductions, especially roads; they include streams, drainage ditches, gullies, swamps, seeps, ponds, lakes, and concave low-lying areas where water collects during rainy weather.

Host ~ A living plant that affords subsistence to a parasite.

Hypha ~ One of the strands or filaments that make up the mycelium of a fungus or fungus-like organism.

Impact ~ A spatial or temporal change in the environment caused by human activity.

Inbreeding ~ Mating between close relatives; often associated with mating in a population consisting of a few individuals.

Infected ~ Refers to the attack of a living organism by a pathogen (the pathogen enters and establishes a pathogenic relationship with its host).

Infested ~ Refers to soil or other substratum that is occupied by a pathogen (used in the sense of "contaminated").

Inoculate ~ To bring a pathogen into contact with a host plant or plant organ.

Inoculum ~ (1) The substance, generally a pathogen, used for inoculating; (2) to put a micro-organism or virus, or a substance containing one of the aforementioned, into an organism or substratum. Also, pathologists use these terms to apply both to inoculations conducted by humans and to inoculations that occur in nature.

In-situ conservation ~ Management of populations onsite to conserve the gene pool in the context of the natural evolutionary processes that occur over time.

Interdisciplinary team (ID team) ~ A group of individuals with varying areas of specialty assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad to adequately analyze the problem and propose action.

Intermittent stream ~ A channel whose base level is above the water table and has a duration of streamflow greater than 30 days, but less than all year. Normally, this type of channel has enough streampower to cause scour or deposition of sediments.

Isohyet ~ A line drawn on a map connecting points that receive equal amounts of rainfall.

Issue ~ A point, matter, or question of public discussion or interest to be addressed or decided through the planning process.

Land management ~ Intentional process of planning, organizing, programming, coordinating, directing, and controlling land use actions.

Land Use Allocations (LUAs) or Land Allocations ~ Use in this SEIS is limited to the seven designations of management emphasis identified in land and resource management plans for each administrative unit as a result of the 1994 "Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl." The seven land allocations are Congressionally Reserve, Late-Successional Reserve, Adaptive Management Area, Managed Late-Successional Areas, Administratively Withdrawn, Riparian Reserve, and Matrix.

Landscape ~ A heterogeneous land area with interacting ecosystems repeated in similar form throughout.

Large woody debris ~ Wood in a stream channel larger than 6 inches in diameter and 10 feet long.

Late-successional forests ~ Forest stands consisting of trees, structural attributes, supporting biological communities, and processes associated with old-growth and/or mature forests. Forest seral stages that include mature and old-growth age classes. Age is not necessarily a defining characteristic but has been used as a proxy or indicator in some usages. Minimum ages are typically 80 to 130 years, depending on the site quality, species, rate of stand development, and other factors.

Late-Successional Reserve ~ Land allocation under the Northwest Forest Plan with the objective to protect and enhance conditions of late-successional and old-growth forest ecosystems that serve as habitat for late-successional and old-growth forest-related species, including the northern spotted owl. Limited stand management is permitted, subject to review by the Regional Ecosystem Office.

Line officer ~ In the BLM and FS, the individual managers in the direct chain of command.

Locus ~ The fixed position of a gene on its chromosome.

Low-risk site ~ A site with characteristics unfavorable for spread and infection by a particular pathogen.

Managed Late-Successional Areas ~ Land allocation under the Northwest Forest Plan; similar to Late-Successional Reserves, but identified for certain owl territories in the drier provinces where regular and frequent fire is a natural part of the ecosystem. Certain silvicultural treatments and fire hazard reduction treatments are allowed to help prevent large-scale disturbance such as fires of high intensity or severity, disease, and insect epidemics.

Management indicator species ~ A species selected because its welfare is presumed to be an indicator of the welfare of other species sharing similar habitat requirements. A species of fish, wildlife, or plants, which reflect ecological changes caused by land management activities

Mating systems ~ Refers to the crossing event or prevalent breeding method within a species. Mating systems can usually be defined as predominately selfing, predominately outcrossing, or mixed-selfing and outcrossing. Conifers are general outcrossing, but selfing also occurs to variable degrees within a respective species.

Matrix ~ Federal lands outside of reserves, withdrawn areas, Managed Late-Successional Areas, and Adaptive Management Areas.

Mature forest ~ A subset of late-successional forests. Mature forests are characterized by the onset of slowed height growth, crown expansion, heavier limbs, gaps, some mortality in larger trees, and appearance of more shade-tolerant species or additional crown layers. In Douglas-fir west of the Cascades, this stage typically begins between 80 and 130 years, depending on site conditions and stand history.

Microclimate ~ The suite of climatic conditions measured in localized areas near the Earth's surface. Microclimate variables important to habitat may include temperature, light, wind speed, and moisture.

Migration ~ The movement of genes from one population to another population; usually referenced as the proportion of new immigrants which move to another population in any one generation.

Mitigation measures ~ Modifications of actions taken to: (1) avoid impacts by not taking a certain action or parts of an action; (2) minimize impacts by limiting the degree or magnitude of the action and its implementation; (3) rectify impacts by repairing, rehabilitating, or restoring the affected environment; (4) reduce or eliminate impacts over time by preservation and maintenance operations during the life of the action; or, (5) compensate for impacts by replacing or providing substitute resources or environments.

Mollusks ~ Invertebrate animals (such as slugs, snails, clams, or squids) that have a soft unsegmented body usually enclosed in a calcareous shell.

Monitoring ~ A process of collecting information to evaluate if objectives and anticipated or assumed results of a management plan are being realized or if implementation is proceeding as planned.

Monitoring and evaluation ~ The evaluation, on a sample basis, of management practices to determine how well objectives are being met, as well as the effects of those management practices on the land and environment.

Mutation ~ A sudden change in genotype; usually a gene mutation (change in single gene) is inferred.

Mycelium ~ The mass of hyphae that makes up the body of a fungus or fungus-like organism.

Mycorrhiza ~ Underground fungi that provide a close physical association between the fungus and the roots of a plant, from which both the fungus and plant appear to benefit. A mycorrhizal root takes up nutrients more efficiently than one not associated with mycorrhiza. Mycorrhizal fungi (also known as ectomycorrhizal) are essential for host plant nutrient uptake and play important roles in nutrient cycling in many forests. Studies from the Pacific Northwest indicate that forest management activities can reduce populations of mycorrhizal fungi and forest regeneration success.

"National Environmental Policy Act" (NEPA) ~ An Act passed in 1969 to declare a national policy that encourages productive and enjoyable harmony between humankind and the environment, promotes efforts that prevent or eliminate damage to the environment and biosphere, stimulates the health and welfare of humanity, enriches the understanding of the ecological systems and natural resources important to the nation, and establishes a Council on Environmental Quality.

"National Forest Management Act" (NFMA) ~ A law passed in 1976 as an amendment to the "Forest and Rangeland Renewable Resources Planning Act," requiring preparation of forest plans and the preparation of regulations to guide that development.

Non-vertebrate species ~ A species that does not have a backbone.

Northwest Forest Plan ~ Coordinated ecosystem management direction incorporated into land and resource management plans for lands administered by the BLM and the FS within the range of the northern spotted owl. In April 1993, President Clinton directed his cabinet to craft a balanced, comprehensive, and long-term policy for management of over 24 million acres of public land within the range of the northern spotted owl. A Forest Ecosystem Management Assessment Team (FEMAT) was chartered to develop a series of options. These options were modified in response to public comment and additional analysis and then analyzed in a final SEIS. A record of decision was signed on April 13, 1994, by the Secretaries of the Department of Agriculture and the Department of Interior to adopt "Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl." The record of decision, including the "Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl" is referred to as the Northwest Forest Plan. The Northwest Forest Plan is not a plan in the agency planning regulations sense; the term instead refers collectively to the 1994 amendment to existing agency land and resource management plans or to the specific standards and guidelines for late-successional species incorporated into subsequent land and resource management plans.

Noxious weed ~ A plant species that is highly injurious or destructive and has a great potential for economic impact; a plant species that is listed as noxious by the State of Oregon.

Off-highway vehicle ~ Any motorized vehicle capable of, or designed for, travel on land, water, or natural terrain. The term will be used in place of *off-road vehicle* to comply with the purposes of Executive Orders 11644 and 11989 (although the definition for both terms is the same).

Old-growth forest ~ An ecosystem distinguished by old trees and related structural attributes. Old growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulations of large dead woody material, number of canopy layers, species, composition, and ecosystem function. More specific parameters applicable to various species are available in the 1993 “Interim Old Growth Definitions” (USDA-FS Region 6). The Northwest Forest Plan SEIS and FEMAT describe old-growth forest as a forest stand usually at least 180- to 220-years old with moderate-to-high canopy closure; a multi-layered, multi-species canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground.

Pathogen ~ A parasite able to cause disease in a particular host or range of hosts.

Percent cover ~ Usually the percent of the ground overtopped by the crowns of trees or other plants.

Perennial stream ~ A stream that flows all year.

Planning area ~ All of the lands within a Federal agency’s management boundary addressed in land management plans. In this case, the portions of the Coos Bay, Medford, and Roseburg BLM Districts and the Siskiyou NF that lie within the natural range of POC.

Plant association ~ A plant community type based on land management potential, successional patterns, and species composition.

Plant community ~ An association of plants of various species found growing together in different areas with similar site characteristics.

Pourpoint ~ Upper extent of streamflow in a drainage system. This point can vary depending upon antecedent soils moisture conditions and prevailing weather.

Prescribed fire ~ Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition.

Propagules ~ Any of various usually vegetative portions of a plant, such as a bud or other offshoot, that aid in dispersal of the species and from which a new individual may develop.

Proposed species ~ Any plant or animal species that is proposed by the USFWS and or NOAA-NMFS in a *Federal Register* notice to be listed as threatened or endangered.

Putative ~ Generally regarded as such; supposed.

Range of the northern spotted owl ~ Area generally comprised of lands in western portions of Washington, Oregon, and northern California.

Rare ~ A rare taxon can be (1) broadly distributed, but never abundant were found; (2) narrowly distributed or clumped, and abundant were found; or (3) narrowly distributed or clumped, and not abundant were found.

Record of decision ~ A document separate from, but associated with, an environmental impact statement that: (1) states the management decision; (2) states the reason for that decision, (3) identifies all alternatives including the environmentally preferable and selected alternatives; and (4) states whether all practicable measures to avoid environmental harm from the selected alternative have been adopted, and if not, why not.

Reforestation ~ The natural or artificial restocking of an area with forest trees.

Reserves ~ Congressionally Reserved Areas (such as wilderness) and land allocations that were designated under the Northwest Forest Plan, including Late-Successional Reserves, Riparian Reserves, and Managed Late-Successional Areas. Reserves help to protect and enhance conditions of late-successional and old-growth forest ecosystems. Stand management actions are either prohibited or limited within these allocations. The likelihood of maintaining a connected viable late-successional ecosystem was found to be directly related to the amount of late-successional forest in reserve status.

Resistant ~ Possessing qualities that hinder the development of a given pathogen.

Restricted road ~ A NF road or segment, which is restricted from a certain type of use or all uses during certain seasons of the year or yearlong. The use being restricted and the time period must be specified. The closure is legal when the Forest Supervisor has issued and posted an order in accordance with 36 CFR 261.

Riparian ~ Pertaining to areas of land directly influence by water. Riparian areas usually have visible vegetative or physical characteristics reflecting this water influence. Streamsides, lake borders, or marshes are typical riparian areas. Vegetation bordering watercourses, lakes, or swamps; it requires a high water table. In this SEIS, sometimes used as substitute for “high-risk sites,” although the two are not synonymous (see text of respective sections).

Riparian area ~ The shoreline zone including floodplains, along a stream or lake, affected by varying levels of subsurface water storage conditions; favoring water tolerant plants and forest vegetation. This linear geographic area is oftentimes extended upslope to include the direct influence of forest trees or to a transitional area between aquatic and terrestrial communities.

Riparian Reserves ~ Areas along live and intermittent streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian Reserves are important to the terrestrial ecosystem as well, serving as dispersal habitat for certain terrestrial species.

Seed zone ~ A seed zone is an area where seed can be moved from a source or seed collection location to a planting location. General adaptation over the long term is inferred within the movement or seed transfer within the respective zone. Most seed zones have a set geographic area where movement is restricted to specific elevation bands (300 meters).

Selection pressure ~ The strength of the tendency to eliminate undesirable genotypes or phenotypes, usually expressed in terms of a selection differential or as a total of the proportion of total trees which are selected.

Sensitive species ~ Those species that: (1) have appeared in the *Federal Register* as proposed for classification and are under consideration for official listing as endangered or threatened species; (2) are on an official state list; or, (3) are recognized by the implementing agencies as needing special management to prevent their being placed on Federal or state lists. Also see *special status species*.

Seral stages ~ The series of relatively transitory plant communities that develop during ecological succession from bare ground to the climax stage.

Soil compaction ~ An increase in bulk density (weight per unit volume) and a decrease in soil porosity resulting from applied loads, vibration, or pressure.

Serpentine ~ A group of common rock-forming minerals such as olivine and pyroxens which are rich in iron, magnesium, and silicate oxides. Serpentines are always secondary minerals and are found in both igneous and metamorphic rocks.

Snag ~ A standing dead tree.

Species ~ A class of individuals having some common characteristics or qualities. In these standards and guidelines, synonymous with taxon, which may include subspecies, groups, or guilds.

Special status species ~ As used in this SEIS, refers only to the following species categories that are included under agency species conservation policies: Oregon/Washington BLM—Bureau tracking, Bureau assessment, and Bureau sensitive (BLM Manual 6840; Instruction Memorandum No. OR-2003-054; Instruction Memorandum No. OR-91-57); California BLM—Bureau sensitive (BLM Manual 6840; Manual Supplement 6840.06, Plant Management); Forest Service Region 5—sensitive (Forest Service Manual 2670); Forest Service Region 6—sensitive (Forest Service Manual 2670).

Spore ~ A general term for a reproductive structure in fungi, bacteria, oomycetes, and cryptogams (analogous to the seed of a green plant).

Stand (tree stand) ~ An aggregation of trees occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition to be distinguishable from the forest in adjoining areas.

Standards and guidelines ~ The rules and limits governing actions, as well as the principles specifying the environmental conditions or levels to be achieved and maintained.

Stochastic ~ The presence of a random variable (for example, the probability of large storms occurring in weather patterns).

Stream order ~ A system of numbering stream channels, where the highest channels in a watershed are labeled order +1, the joining of two like +1 is a +2 order, the joining of two like +2 is a +3 order and so forth. The main stream is always the highest order.

Substrate ~ Any object or material on which an organism grows or is attached.

Subwatershed ~ A delineated hydrologic unit depicting the location of a drainage area that is typically 10,000 to 40,000 acres in size (it can be as small as 3,000 acres); the 6th division level of the Nation's drainages; represented by extending the 10-digit hydrologic unit code to 12 digits (*Source:* http://www.ga.usgs.gov/gis/iag.html and http://www.reo.gov/gis/projects/watersheds/Data_Standards2.htm).

Succession ~ A series of dynamic changes by which one group of organisms succeeds another through stages leading to a potential natural community or climax. An example is development of a series of plant communities (called seral stages) following a major disturbance.

Supplemental environmental impact statement (SEIS) ~ As defined by NEPA, a supplement to an existing EIS is prepared when: (1) the agency makes substantial changes to the proposed action that are relevant to environmental concerns; (2) there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts; or, (3) the agency determines that the purposes of NEPA would be furthered by doing so.

Survey and manage ~ Mitigation measure adopted as a set of standards and guidelines within the Northwest Forest Plan record of decision and replaced with standards and guidelines in 2001 (record of decision) intended to mitigate impacts of land management efforts on those species that are closely associated with late-successional or old-growth forests whose long-term persistence is a concern. This mitigation measure applies to all land allocations and requires land managers to take certain actions relative to species of plants and animals, particularly some amphibians, bryophytes, lichens, mollusks, vascular plants, fungi, and arthropods, which are rare or about which little is known. These actions include: (1) manage known sites; (2) survey prior to habitat-disturbing activities; and (3) conduct extensive and general regional (strategic) surveys.

Susceptible ~ Lacking the inherant ability to resist disease or attack by a given pathogen (not immune).

Talus ~ The loose accumulation of fragmented rock material on slopes, such as at the base of a cliff.

Threatened species ~ Plant or animal species likely to become endangered throughout all or a significant portion of its range within the foreseeable future. A plant or animal identified and defined in accordance with the 1973 "Endangered Species Act" and published in the *Federal Register*.

Threatened species ~ Any species defined through the "Endangered Species Act" as likely to become endangered within the foreseeable future throughout all or a significant portion of its range and published in the *Federal Register*.

Tracking species ~ A special status species category established by Oregon/Washington BLM. The purpose of tracking species is to enable an early warning for species which may become threatened or endangered in the future. BLM districts in Oregon and Washington are encouraged to collect occurrence data on species for which more information is needed to determine status within the state or which no longer need active management. Until status of such species changes to Federal or state listed, candidate of assessment species, tracking species will not be considered as special status species for management purposes.

Ultramafic ~ Igneous rocks composed chiefly of mafic minerals such as augite or olivine. A general name for plutonic rocks with color index M greater than or equal to 90, including, among others, dunite, peridotite, and pyroxenite.

Unconfined channel ~ A stream that can access the floodplain when flows are greater than the normal channel dimensions.

Understory ~ The trees and other woody species growing under the canopies of larger adjacent trees and other woody growth.

Upland ~ Out of (above) the riparian zone.

Viability ~ Ability of a wildlife or plant population to maintain sufficient size to persist over time in spite of normal fluctuations in numbers, usually expressed as a probability of maintaining a specific population for a specified period.

Viable population ~ A wildlife or plant population that contains an adequate number of reproductive individuals appropriately distributed on the planning area to ensure the long-term existence of the species.

Watershed ~ That land area that is separated from other land areas by a divide, contributing water or snowmelt, organic material, sediments and nutrients to a stream; synonymous with catchment.

Well-distributed ~ Distribution sufficient to permit normal biological function and species interactions, considering life history characteristics of the species and the habitats for which it is specifically adapted.

Wetlands ~ Areas that are inundated by surface or ground water with a frequency sufficient to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, wet meadows, river overflows, mud flats, and natural ponds.

Width/depth ratio ~ The width of a stream, divided by its mean depth.

Wilderness ~ Areas designated by congressional action under the 1964 “Wilderness Act.” Wilderness is defined as undeveloped Federal land retaining its primeval character and influence without permanent improvements or human habitation. Wilderness areas are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or for a primitive and confined type of recreation; include at least 5,000 acres, or are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and may contain features of scientific, educational, scenic, or historical value as well as ecological and geologic interest.

Wildland fire ~ Any non-structure fire, other than prescribed fire, that occurs in the wildland.

Index

Appendices —

Appendix 1: Port-Orford-Cedar Management Guidelines

The "Port-Orford-Cedar Management Guidelines" (1994) are included here because they are part of current management direction for the Roseburg, Medford, and Coos Bay Bureau of Land Management (BLM) Districts referenced in the description of Alternative 1 in Chapter 2. The document was retyped in its entirety during the preparation of this draft supplemental environmental impact statement (SEIS), and any differences between this version and the original are editorial only. Note that the Table of Contents page numbers have been changed to reflect formatting for insertion into this document.

PORT-ORFORD-CEDAR MANAGEMENT GUIDELINES

U.S. Department of the Interior
Bureau of Land Management

September 1, 1994

Prepared by:

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[Note: This document was re-typed during the preparation of the draft Port-Orford-Cedar Supplemental Environmental Impact Statement. Any differences between this version and the original are editorial/formatting only.]

PORT-ORFORD-CEDAR MANAGEMENT GUIDELINES

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TABLE OF CONTENTS

I. INTRODUCTION

POC (Chamaecyparis lawsoniana [A. Murr.] Parl) (abbreviated hereafter as POC) is a minor but valuable component of the forests of southwester Oregon and northwestern California. It is usually found as scattered individuals in a stand but can also occur in continuous stands. Population distribution inland is usually associated with drainages, particularly in the southern portion of its range (Atzet, 1993). The species occurs primarily at low-to-mid elevations but has been found up to approximately 7,000 feet in northern California (Greenup, 1992a). The greatest concentration of POC is in Oregon in the northern third of its range, on the coastal hills and terraces from Coos Bay to Port Orford and in the adjacent southern edge of the Coast Range, including the drainages on the middle and south forks of the Coquille River (Zobel, 1985). Secondary concentrations occur inland at moderate-to-high elevations near the Oregon/California border and in the watersheds of Grayback Creek and Deer Creek in southeastern Josephine County, Oregon (Atzet, 1979; Hawk, 1977). Throughout its range, the species is under attack by the fatal fungal pathogen Phytophthora lateralis (P. lat.), which causes POC root disease (Kliejunas, 1981). Forest management activities such as road construction, timber harvest, site preparation, and fuels treatment can increase the risk of spreading the disease by introducing the pathogen to uninfested areas.

POC spans the floristic transition one between the vegetation of California and the Pacific Northwest (Harrow and Harrar, 1969). POC occurs in five plant series in the Klamath Province: white fir (Abies concolor Gord. & Glend.), western hemlock (Tsuga heterophylla [Raf.] Sarg.), POC, tanoak (Lithocarpus densiflorus [Hook and Arn.], Rehd.), and Jeffrey pine (Pinus jeffreyi Grev. And Balf.) (Atzet and Wheeler, 1984). Tree associates range from Sitka spruce (Picea lsitchensis [Bong.] Carr.) in the northern part of the POC range to incense-cedar (Calocedrus decurrens [Torr.] Florin) at the lower latitudes. Other common tee species associated with POC include Douglas-fir (Psuedotsuga menziesi montícola Dougl.), sugar pine (Pinus lambertiana Dougl.), and red alter (Alnus rubra Bong.) (Harlow and Harrar, 1969). In addition, the range of POC overlaps an area of high plant diversity containing many other endemic species.

POC is limited to areas with relatively high ratios of precipitation to evaporation (Zobel et al., 1985). POC is opportunistic, and it can establish itself in quantity during early seral stages, after disturbance in stands and under an intact forest canopy. The species is shade tolerant and also grows well in the open. Zobel (1990) found that POC reached breast height in 5 to 11 years in clearcuts; and under a forest canopy, it took 14 to 31 years. Good seed crops can occur as often as every 4 or 5 years but generally not for 2 years in a row (Zobel, 1979).

II. PHYTOPHTHORA LATERALIS AND PORT-ORFORD-CEDAR

The first external evidence of the root disease is a slight discoloration of the foliage which, within a few weeks to months, depending on the weather conditions and tree size, gradually takes on a yellow wilted appearance. The color changes from yellow to bright red, then to red-brown, and finally brown. Trees usually lose all foliage 2 to 3 years after death. POC root disease is best identified by the cinnamon-colored inner bark and cambium that abruptly joins the creamy white, healthy inner bark in roots and lower boles. Just prior to tree death, the discolored zone may extend 2 to 5 feet above ground (Hadfield et al., 1986).

An infection of P. lat., possible and introduced pathogen, was first reported in an ornamental POC near Seattle, Washington, in 1923. It was fond in southwestern Oregon in 1952 (Roth et al., 1987). There is no proven resistance to P. lat. with POC although occasional POC remain alive after surrounding POC have been killed (Hansen et al., 1989). Whether this survival is due to some degree of resistance or lack of exposure of the pathogen remains unclear.

P. lat. is a root-inhabiting fungus transmitted via soil and/or water. The pathogen enters through root grafts or directly through the tips of fine roots (Gordon and Roth, 1976). Damage from this moisture- and low-temperature-dependent fungus peaks during the cool, wet season; but crown symptoms lag behind due to abundant atmospheric moisture. As moisture stress builds in late spring and summer, the damaged root system is unable to meet the evapotranspiration requirements of the tree. This results in the simultaneous death of the crown (Zobel et al., 1985). While seedlings and small POC quickly succumb to the pathogen, large POC may take a year or more to die.

The resting spores (chlamydospores) develop in rootlets and are released into soil as the roots deteriorate. The dormant chlamydospores form fruiting bodies (sporangia) in saturated soil, which in turn release motile zoospores. Zoospores required flowing water to travel any distance. The fungus survives as chlamydospores in soil without a host for up to 4 years in northwestern California (Kliejunas, 1992). Spore survival, without a host, in the Coos County forest and at Oregon State University has reached 6 years and 7 years, respectively. At both sites, chlamydospore population levels are on a downward trajectory (Hansen, 1994).

Chlamydospore survival rates decline during periods of summer drought, which is a normal occurrence in portions of the range of POC. A significant decrease in spore survival occurred when isolated organic matter, and organic matter in soil containing P. lat. spores, was stored in sealed plastic bags and heated to 68 degrees Fahrenheit for a period of 18 weeks. At this same temperature, survival of P. lat. in organic matter was favored in moist soil, but not in saturated soil. Naturally infested organic matter in clay soil stored in sealed plastic bags did not show a decreased survival in moist soil (0.3 bars tension), but did show decreased survival in saturated soil (0 bars tension). In slightly dried soils (approximately 25 bars tension), P. lat. survived at only very low levels after 16 weeks at 68 degrees Fahrenheit (Ostrofsky et al., 1977).

Spore transport occurs via a variety of mechanisms. Logging equipment, vehicles, humans, and animals (particularly elk) can transport infested soil (Zobel et al., 1985). It can be transmitted by surface water in streams or ditches. Disease transmission can also occur via root grafts and, in some rare instances, through rain splashed spores (Gordon, 1974). Trees in close proximity to the stream channel downstream from infected areas have the best chance of contracting the disease. Upslope spread is more difficult, occurring through root grafts and possibly by disease movement from infected to uninfected POC roots that are in close proximity to each other (Gordon, 1974).

If soil infested with chlamydospores is transported to uninfested areas, new infections can occur. This requires a precise sequence of events: chlamydospores must reach POC root tips; germination must occur; and the root tips must be penetrated to initiate infection. P. lat., while fatal to POC, may not be the sole cause of death in a given tree. Microsite conditions such as moisture stress, mechanical damage, or insects can contribute to mortality.

Once a tree becomes infected, mortality is frequently rapid. However, when infestation occurs in an area, it is rare for all of the POC to become infected. Surveys done in areas where the pathogen has been present for 30 years have shown that not all POC were killed (Schoeppach, 1991). Whether this phenomenon is due to resistance, isolation, unknown factors, or a combination of these, is not clear.

III. PHYTOPHTHORA LATERALIS AND PACIFIC YEW

Recently, it has been documented that Pacific yew (Taxus brevifolia Nutt.) is also susceptible to P. lat. (DeNitto and Kliejunas, 1991; Greenup, 1992). Pacific yew contains taxol, a compound which has shown promise as an ovarian cancer treatment. The Pacific yew mortality only occurred in areas where there are also infected POC. No mortality due to P. lat. has been documented on BLM lands.

Pacific yew infected with P. lat. show the same symptoms as those seen on infected POC. Crown discoloration and cambium stain occur. It appears that the resistance to P. lat. within Pacific yew is more variable than that seen in POC (Greenup, 1992a).

IV. MANAGEMENT OBJECTIVES FOR PORT-ORFORD-CEDAR

POC requires special protection because it is an important component of some forest ecosystems, it is economically valuable, and it is vulnerable to an introduced pathogen that is spread primarily through human activities.

A. Proactive management – limit the spread of *P. lat.* and reduce the number of infested areas.

B. Retain POC as a species, identify resistant individuals, and incorporate them into a tree improvement program.

C. Incorporate *P. lat.* control strategies as management objectives in Riparian Reserves (RRs), Late-Successional Reserves (LSRs), and Matrix.

D. Provide POC as a primary forest product.

E. Promote public involvement in POC management.

F. Develop a budget and implementation schedule for the Port-Orford-Cedar Management Program.

V. IMPLEMENTATION STRATEGY TO ACHIEVE POC MANAGEMENT OBJECTIVES

A. Proactive management – limit the spread of *P. lat.* and reduce the number of infected areas.

The intent is to stop the spread of *P. lat.* into POC and Pacific yew populations, and to design and implement management strategies that decrease the number of disease locations in a manner consistent with objectives identified in district resource management plans. At present, no documentation exists that indicates a successful eradication of *P. lat.*, on a specific site has been accomplished. A management strategy for an area may include POC eradication and preventing POC regeneration until the inoculum present on the site dies out. The ultimate goal is to reestablish POC into those areas where the pathogen had previously existed.

An accurate inventory of POC and *P. lat.* is essential for the development of a management strategy. Populations of POC should initially be mapped geographically by plant series and associations. Areas where POC is found should then be subdivided according to seed zones and elevation bands. Areas where timber harvest has occurred that still contain POC populations must be examined for the occurrence of *P. lat.* Areas with POC present, and where no harvest activities have occurred, should receive the same analysis.

The inventory of POC and *P. lat.* areas will be ongoing as the POC management strategy is implemented. At a minimum the inventory should include the following:

1. Determine which POC areas also have populations of Pacific yew.

2. Track all occurrence of POC populations and *P. lat.* infestations in MICRO*STORMS (M*S) and Geographic Information Systems (GIS).

3. Analyze the relationships between infested and uninfested areas (i.e., what is the probability of the uninfested stand becoming infested?) Further analysis should examine if *P. lat.* infested sites are expanding, stable, or decreasing, the relationship of *P. lat.* population trends to land management activities, and the specific reasons for the impacts to *P. lat.* populations.

4. Monitor for occurrence of *P. lat.* and the effectiveness of management of the pathogen and disease control. Monitoring projects will need to continue for at least 5 years in the drier portions of the range of POC and for longer periods where climatic conditions are wetter.

This information should be consolidated in an annual report.

All entries into POC areas should be coordinated with the district POC program lead and the resource area silviculture group(s). The forest development program should incorporate POC objectives in reforestation, timber stand improvement, and the development of silvicultural prescriptions. Strategies to meet road construction, renovation, maintenance, and road management objectives need to include POC goals. Existing timber sales that do not address POC should be modified to include consideration for POC management. Entries are not just those for timber sales or silvicultural activities. They include, but are not limited to, such things as firewood cutting, hunting, and any other actions within POC areas.

There are at least three key risk indicators regarding the introduction of *P. lat.* to uninfested sites. The first is the potential for infested soil to be transported upstream of uninfested POC areas due to an increase in exposure points such as steam crossing or roadwork (new construction, renovation, maintenance, or decommissioning). Recreational activities such as horseback riding, off-road vehicle traffic, or even mountain bike riding could also increase the chances of *P. lat.* infection. The second factor Is the duration of the increased risk; that is, the number of trips by logging trucks, logging machinery, etc. The more trips, the greater the potential for infection. The third risk indicator is the season in which activities occur in POC areas. Activities that occur during the wet season have a greater potential to move infested soil to areas that presently do not contain *P. lat.* A risk analysis procedure has been developed by the USFS and is presented as Appendix 4 is this paper. This appraisal should be conducted for all areas containing POC.

POC, *P. lat.*, and Pacific yew mapping will be the key to success of the Interregional POC Coordinating Group, of which BLM is an active participant. This group was established in 1987 to ensure a coordinated, interregional, interagency effort to manage the root disease. The group structure has recently been reorganized into two areas: a policy oversight team and a technical team. The policy oversight team will include a representative from: (1) Forest Pest Management in USFS Region 5, (2) Forest Insects and Diseases Group in Region 6, (3) the Forest Supervisors, and (4) the Oregon/Washington State Office and Medford District Office of the BLM.

B. Retain POC as a species, identify resistant individuals, and incorporate them into a tree improvement program.

The goal is to join with the USFS in its research program to identify genetic resistance to *P. lat.* Resistance is defined as slowing the rate of a pathogen's advance in diseased tissue, rather than immunity. No trees have been identified that have the potential to stand up indefinitely in areas of extreme inoculum exposure. However, though a breeding program, the possibility of producing stock with a high level of resistance certainly may exist (Martinson, 1994). As with Douglas-fir, POC has a wide tolerance for variations in environment (probably related to genetic variability) that allows it to compete successfully in a wide range of environmental conditions (Millar et al., 1991). This great ecological amplitude of POC is believed to reflect a geographic concentration of genetically-based characteristics that had developed in a much larger geographic range (Edwards, 1983).

In the past, ornamental varieties of POC have been grafted to root stocks of *P. lat.*-resistant members of the family Cupressaceae with varied success (Torgeson et al., 1954). Research continues regarding POC and *P. lat.* Currently, the Pacific Southwest Research Station is conducting a rangewide genetics study on POC. Under contract with the USFS, researchers at Oregon State University are evaluating the survival of potentially resistant parent trees, collecting seed and vegetative material from parent trees for propagation, and screening seedlings and rooted cuttings for resistance (Greenup, 1992b). With the exception of the Coos Bay District, BLM has not been actively involved with these programs in the past. However, there are opportunities to support upcoming studies on POC. Specific actions include, but are not limited to, identification of resistant POC, cone collections from suspected resistant individual trees, and outplanting of seedlings grown from collected seed to test resistance. These research opportunities should be anticipated and aggressively pursued. Management objectives and practices will need to be reviewed and updated as additional research is published.

Current searches for resistance are in highly-infested areas where selection pressure has been present for some time. Single trees that have survived in areas of sever mortality may be resistant. Harvesting or precommercial thinning of POC in infected areas should be preceded by evaluation of the POC population for resistance. All trees should not be tested, as this is biologically unnecessary as well as financially impractical. Even the most ambitions sampling schemes cannot test all trees within a given population. The probability of removing a tree with some level of resistance is extremely low in areas that have not seen extensive mortality (Greenup, 1992a).

The current screening process for POC with resistance has been underway for over 10 years. The screening criteria was developed by Dr. Lewis Roth and Dr. Everett Hansen of Oregon State University, Don Goheen of the Southwest Oregon Forest Insect and Disease Technical Center et al. Screening includes POC stem inoculation with *P. lat.*, soil inoculation with *P. lat.* and transplanting POC into the infested soil, and immersing the root of seedlings and rooted cuttings in a water suspension of *P. lat.* zoospores (Hansen et al., 1989). Over 200 selected trees are currently being evaluated for resistance. Discussions with USFS geneticists and pathologists indicate an extremely low potential for loss of resistance by harvesting or other removal of POC (Greenup, 1992a). Timber sales involving green POC should be evaluated for resistance candidates prior to harvesting.

<u>Guidelines for selecting trees in the wild for resistance:</u>

1. Select trees that appear to have been exposed to the fungus. Selected trees should retain green crowns and be in close proximity to those exhibiting symptoms of *P. lat.*

2. Select trees in previously infested areas that stay wet for long periods of time.

3. Selected trees that are not elevated on rises above existing infected trees. Roots should be wet or have been subjected to the same water flow as infected trees.

4. The candidate tree should have root disease killed trees above and below it on the same slope.

5. Trees should have normal-looking green foliage and should have been exposed at the time the existing dead trees were exposed.

6. POC roots graft with roots of other POC. In wet areas, the pathogen will involve the entire area.

7. Trees occurring on the edges of visibly infested sites can be selected for resistance testing if they meet the probably exposure criteria (Greenup, 1992a).

Some POC populations occur on lands set aside for uses other than timber production. It will be necessary to ascertain which seed zones and elevation bands containing uninfected POC colonies are not represented in the set aside areas. Additional uninfected POC populations may need to be reserved for maintenance of POC gene pool diversity. Populations that are reserved should be selected by plant series and associations. POC genetic diversity appears to increase with decreasing elevation and soil diversity (Millar and

Marshall, 1991). In general, BLM lands are lower in elevation than those administered by the USFS. Therefore, POC populations on BLM lands may have a greater genetic diversity that that currently known to exist.

C. Incorporate *P. lat.* control strategies as management objectives in RRs, LSRs, and in the Matrix.

There are some specific situations involving POC management that deserve distinct consideration: management actions in infested RRs, LSRs, within the Matrix, or other special management areas that contain *P. lat.* or uninfected POC. These areas will require application of site-specific procedures. With careful consideration, an integrated strategy can be developed where more than one resource value can be enhanced. Any action(s) taken must be consistent with the management objectives identified in the district RMO for these areas.

1. Riparian Reserves

Riparian areas may contain diseased POC. In some areas, it may be possible to remove POC while at the same time maintaining riparian quality. To realize the full benefits for the riparian management area, consult with the wildlife biologist, fisheries biologists, hydrologists, and other resource specialists to identify the specific objectives for that riparian area, and how POC management can assist in attaining these goals. POC management within RRs must conform to the Aquatic Conservation Strategy (USDA and USDI, 1994).

Live trees showing signs of infection, but needed to increase the dead wood component in riparian areas, could be girdled and left to fall or felled intentionally if additional down woody material is required immediately. The presence of snags and logs in most environments make them particularly valuable to amphibians (Oliver, 1992). One contribution from POC management that could provide immediate and future benefits is the status of the coarse woody material component of the riparian area. Determine whether the riparian area's present and predicted future requirements for large woody material are being and will continue to be met. If additional material is required, specialists can use geometric and empirical equations based on tree size and distance from the stream to identify POC that can provide large woody material recruitment (Robinson and Beschta, 1990). Because of their resistance to decay, POC snags and logs are long-lived components of riparian habitat (Jimerson and Creasy, 1991).

Riparian area containing dead or diseased POC must be surveyed to determine whether an adequate amount of snags and down logs exist. Girdled trees would create snags and future sources of coarse woody debris. If existing levels of down wood are less than desired, POC could be felled; either to provide down logs outside the stream or to crate an in-channel structure. POC logs also provide organic input as well as structure to streams where anadromous fish spawn.

Preliminary work has been done in determining these figures. USFS data for both the POC and Tanoak series give some indications of the snag component for these forest communities where little human disturbance has occurred (Atzet and McCrimmon, 1992). Unfortunately, data for down coarse woody material has yet to be developed; but the case can be made that is the natural snag component is maintained over time, coarse woody debris requirements will also be maintained. Snags and other woody debris need not, and should not, be recruited solely from POC; but dead POC does present an opportunity to provide a habitat component that may be lacking.

Since the disease can move via root grafts, monitoring would be required to determine if root contact between uninfested POC and the infection center has been broken. There is little information available regarding the development of POC root systems. The only detailed description of POC root systems is for a 50-year-old dense stand in coastal Coos County. In this stand, 0.6 percent of the major roots extended beyond 6.7 meters from the bole of the tree (Gordon, 1974; Gordon and Roth, 1976). Based on this work, treating an area infected with *P. lat.* could include green POC adjacent to the infection site and currently showing no sign of *P. lat.* This could involve the removal of the live host (green trees that show no sign of infection) adjacent to the infection site. Again, removal could involve girdling, cutting and leaving the tree, or even harvesting the green POC. Elimination of live POC adjacent to infection sites would further reduce the potential for *P. lat.* propagation. This strategy has been implemented on the Gold Beach Ranger District, Siskiyou National Forest (Gee, 1993). In this case, all POC within a distance equivalent to five times the crown radius of the infected tree(s) have been removed.

There will often be portions of the RR infested with *P. lat.* that have POC too small to be girdled. One management approach could be to girdle POC greater than six inches dbh, slash smaller POC (down to 1 inch in diameter at 1 foot), and use prescribed fire to kill POC that are too small to slash. The prescribed fire treatment utilized could be a broadcast burn, underburn, swamper burn, or whatever application of fire best fits the objectives for the riparian management area. Of course, this would only be applicable where prescribed fire is consistent with RR objectives. Due to the sensitivity surrounding the use of herbicides, it is recommended that they not be utilized in removing POC.

No commodity extraction of POC should occur prior to a watershed analysis. After a watershed analysis is complete commodity extraction could occur if it is consistent with objectives identified in the watershed analysis.

2. Late-Successional Reserves

A second area of concern are areas containing *P. lat.* that are within LSRs. Management objectives for LSRs are to protect and enhance conditions of late-successional and old-growth forest ecosystems which serve as habitat for late-successional and old-growth-elated species, including the northern spotted owl (USDA-USDI, 1994). In those areas where POC provides a significant portion of the forest canopy, *P. lat.* could, over time, contribute to canopy loss and be detrimental to maintaining quality LSR habitat. Treating the pockets of *P. lat.* that occur within LSRs will have some short-term impact on canopy cover and species diversity; but by isolating or eliminating the diseased area or areas, POC may be retained inside the LSRs and contribute to overall species diversity.

As stated above under RRs, considerations for snags, down woody material, and their associated resource values are necessary in LSRs. Consultation with wildlife biologists and other resource specialists will determine management opportunities. Creative management can reduce *P. lat.*, enhance the amount of snags and down woody material, ensure snag and down woody material recruitment, and perhaps even provide some timber volume for commodity production.

The intent is to isolate *P. lat.*-infested areas and to reduce the potential for spread of the pathogen via root grafts. This could be accomplished by removing green POC from around the periphery of disease centers. This would accomplish two objectives. POC populations would be separated into populations of infected and uninfected POC, and the possibility of locating resistant POC within the infested areas would be retained. The possibility exists that girdled POC or severed POC stumps may remain alive due to root grafting. However, it has been shown that most roots not directly involved with root grafts die (Bornamm, 1966). Therefore, even if the severed or girdled POC stumps remain alive, benefit can be achieved by reducing the receptive sites for *P. lat.* (Gordon, 1974).

The emphasis in LSRs is not on timber as a commodity. It is recommended that POC harvest or salvage occur only after realizing other resource objectives which might benefit from large woody material input from POC. Snags can serve a variety of purposes for wildlife including, but not limited to, nesting platforms, feeding substrates, and roosting sites. While the decay rate of POC snags is not clear, a related species, western red cedar, has been shown to be the most persistent snag in forests of Coast Range (Cline, 1977). While this may provide for long-term utilization of POC snags for the uses previously mentioned, slow decay rates may reduce the opportunity for cavity nesters to occupy POC snags. Wildlife use of POC snags appears not as high as that of pines or Douglas-fir, but this is likely partially offset by the longevity or the snags (Jimerson, 1989). The level of large woody material input from POC will have to be determined through an interdisciplinary analysis and occur on a site-specific basis.

Preliminary data from USFS ecology plots in the POC series shows that while stands have the potential to become dominated by POC, there are generally other conifers and hardwoods present that contribute to stand structure and canopy closure (Atzet and McCrimmon, 1992). Data combined from all the plots in the POC series indicated that POC is normally not the dominant tree in those stands. If this situation exists, then removal of the live host of *P. lat.* may be possible without significant loss of canopy cover in the POC series that occur in spotted owl habitat.

3. Matrix

Most timber harvest and other silvicultural activities will be conducted in that portion of the Matrix with suitable forest lands (USDA-USDI, 1994). Stands in the Matrix can be managed for timber and other commodity production, but they also have an important role in maintaining biodiversity. Silvicultural systems for stands in the Matrix should provide for the retention of old-growth ecosystem components such as large trees, snags and down logs, and depending on site and forest type, a diversity of species (Thomas et al., 1993). Green tree retention is a significant component in the management of Matrix lands. Green trees can be retained, both as individuals and in well-distributed patches. Patches of green trees of various sized, ages, and specie swill promote species diversity and may act as refugia or centers of dispersal for many organisms including plants, fungi, lichens, small vertebrates, and arthropods (Esseen et al., 1992). Patches of green trees may also provide protection for special microsites such as seeps, wetlands, and rocky outcrops.

POC should be treated the same as any other commercial species in the Matrix. Special considerations for this species are identified later in the document (see following Mitigating Measures for Timber Sale and Service Contractors). Rather than girdling and leaving POC as mentioned above in the RRs and LSRs, merchantable POC can be removed for commodity production. It is recommended that areas of *P. lat.* be targeted for POC harvest. Residual uninfected POC can be left as part of the green tree retention previously described. Slashing of small POC and prescribed fire may be used to eliminate unmerchantable POC from infested areas. This removal of the host species could reduce the presence of *P. lat.*; and if POC is eliminated from a diseased site for more than 5 years, there is the potential for *P. lat.* to die out. This 5-year-time-period is for the drier portions of the POC range. More mesic sites, such as those found in the Coos Bay District, will require a longer period of POC absence in order for *P. lat.* to die out.

Monitoring will be essential to track the existence of P. lat. One potential monitoring technique is to plant small quantities of POC in areas suspected of still being infested. This could be done as a cluster plant with other species not susceptible to P. lat. If the disease is still present, mortality in the POC would show up quickly and could be documented in stocking surveys at the end of the first growing season. If no POC mortality occurs, the excess conifers resulting from the cluster plant could be removed (Viets, 1993).

D. Provide POC as a primary forest product.

POC can be exported as whole logs from Federal lands. A species can be exported if it can be shown that domestic use of the timber is absent or minimal (Land, 1992). Hinoki (Chamaecyparis obtusa) is used in the construction of homes and temples in Japan. Due to decreasing populations of hinoki, the demand for POC has increased. Five dollars per board foot or $5,000 per thousand have been paid for POC (Brattain and Stuntzer, 1994).

Matrix lands infested with P. lat. should be targeted for salvage operations as soon as possible. Reserves should be considered for salvage only after the appropriate analysis has been completed (watershed analysis for RRs or management plan for LSRs). It is recommended that mortality salvage operations occur within 3 years of the death of any POC in the Matrix, and as soon as possible in other areas as long as the salvage is consistent with management objectives. The export value of POC was reduced after 3 years due to a decrease in grade (Zobel et al., 1985). This contrasts with POC killed by fire. Fire-killed trees can retain their merchantability for a longer period of time due to exterior charring. In addition to salvage, green POC should be removed from around the infested area to reduce the possibility of disease transmission via root grafts. The distance for removal of POC would have to be determined on a site-by-site basis.

Areas not infested by P. lat. need not be off limits to timber harvest. However, steps must be taken to reduce the probability of initial infection. Mitigating measures for timber sale and service contracts are listed in Section VI below. It is anticipated that a helicopter would frequently be the logging system of choice, but conventional systems could also be used when they are consistent with management objectives for the area.

E. Public Involvement

Public education and media involvement should be incorporated into our guidelines. Groups such as the Oregon Natural Resource Council, the Western Environmental Law Center, Inc., the Siskiyou Regional Education Project, the Nature Conservancy, and the Sierra Club have indicated interest in POC management. Involvement and coordination with private landowners and other neighbors will provide better awareness of P. lat. problems, reduce the potential for new P. lat. infections, and help organize the management of POC and P. lat. across ownerships. Upon adoption of a rangewide POC management plan, a news release could be issued to the media. There has already been interest shown by members of the press as the information regarding Pacific yew susceptibility to P. lat. has become more widely known. Educational signs identifying road closures for POC and P. lat. management should be posted in all areas containing POC. Lectures to interested groups could also enhance the image of the BLM POC management program. A brochure similar to the USFS pamphlet, Port-Orford-Cedar Root Disease (FPM Report #294), should also be developed by BLM.

F. Develop a budget and implementation schedule for the POC Program.

POC areas should be mapped, and lists of the Operations Inventory Units containing POC should be developed. The next step is to develop lists of infested and uninfested areas containing POC.

Without an accurate inventory of POC and P. lat. occurrence, successful management of POC and P. lat. has little chance of success. The suggested procedure is as follows:

Inventory	General survey for POC and P. lat. Determine the extent of the POC and P. lat. (Are all POC infected?). Map areas with and without P. lat.
Implementation Plan Develop	M*S and GIS: Input data into MICRO*STORMS and GIS. Development GIS maps of POC and P. lat. areas and input recommended treatments into M*S database.
Plan Monitoring, Ongoing Adaptive management, and Modification	

Future needs will focus on developing site-specific management plans for all areas containing POC, and monitoring POC areas to see if the disease has been isolated or eliminated from infected areas and fprevented from spreading into disease-free areas.

VI. MITIGATING MEASURES FOR TIMBER SALE AND SERVICE CONTRACTS

It appears that when areas of POC and P. lat. are accurately mapped and mitigation measures are implemented, the successful spread and establishment of the disease into new watersheds is a rare event. The use of effective mitigation measures, combined with a low risk of establishment following the spread of the disease, has prevented the spread of the disease into uninfested watersheds in California (Kliejunas, 1991).

A. Restrict road building and log hauling to the dry season unless the contract calls for cleaning the vehicles to prevent/reduce import or export of the root disease. This will lessen the chance of infested soil adhering to equipment and vehicles and consequently from being transported to uninfested areas.

B. Road design: When feasible, outslope the roads or use crushed rock to keep the soil in place. A slight outslope is best as the soil landing on the fill slope has a low probability of ending up in streams. Insloped roads will cause soil to end up in the ditch and eventually enter into streams, placing downstream POC populations in jeopardy. Culvert and waterbar placement should also divert water from areas where POC exists.

C. In POC areas, do not allow blading into road ditches upstream from the uninfested areas. Blade to the fill slope only. Do not allow sidecasting where sidecast material could reach the stream channel.

D. Wash with chlorine bleach and water or require steam cleaning or high pressure water treatment for all machinery and vehicles prior to entry into the uninfested project areas. Require the same washing and cleaning for machinery and vehicles prior to departure from infested sites. The ration of chlorine bleach and water for vehicle washing is 12 ounces of bleach per 1,000 gallons or water. Charge the vehicle cleaning to the timber sale or whatever activity requires entry into the POC area. See Appendix 2 for additional information.

E. Gate or barricade roads in areas containing POC, both uninfested and infested, when consistent with other resource objectives. This prevents vehicle introduction of P. lat. into uninfested areas and the transport of P. lat. out of infested areas. Lack of access also reduces the potential for theft and can be incorporated into the resource area road closure policy designed to benefit resources other than timber such as terrestrial wildlife, fisheries, and other values identified as part of the Aquatic Conservation Strategy.

F. In timber sales containing infested and uninfested areas, harvest uninfested areas first so that the equipment does not become contaminated and the contamination moved to uninfested areas.

G. Use chlorine bleach and water or steam cleaning to wash chokers and equipment if a helicopter yarding system is used.

H. Have an interdisciplinary team review and make recommendations to the area manager on all activities in POC areas. Fisheries projects, riparian enhancement, and recreation site development are examples of undertakings that should have interdisciplinary team review.

I. Remove the belly plate from all tractors that have worked in infested areas, and steam clean or wash the tractors with chlorine bleach and water prior to leaving the site. In uninfested areas, steam clean or wash all skidding, yarding, and hauling equipment prior to entering the site. See Appendix 3 for specific vehicle parts that may require cleaning.

J. Do not allow POC bough cutting until the following steps are completed:

1. Inventory for POC and P. lat.
2. Determine if bough cutting is consistent with management objectives for the area.
3. Only allow bough cutting in small areas where administration and law enforcement have easy access.

K. Develop monitoring plans for all POC areas. This could include such things as checking contract diaries for rainfall events during logging and activities outside of the scope of the contract.

L. Coordinate with the USFS, state and county forestry departments, private groups, and individuals that have an interest in POC management.

M. Require roadside brushing: (all distances are slope distances)

1. Upslope: Cut all POC within 20 feet of the road edge; if cutslopes are greater than 5 feet in height, remove POC only between the road edge and the top of the cutslope.

2. Downslope: All POC within 50 feet of the road edge, downslope from the stream crossing, and all POC that have roots within the stream channel should be killed where the stream channel intersects the road right-of-way.

These disturbances are used as examples and can be modified to fit a particular situation. In addition, this is not mandatory and should only be used when there is a high likelihood of importing P. lat. into a project area where other mitigating measures have low potential for success.

N. Reforestation: Plant POC at 25-foot spacing or in approximately 1-tree clusters at 100 to 150 foot spacing. This does not apply to planting mentioned above where presence of P. lat. is being determined.

O. Precommercial thinning: Allow for adequate spacing between POC in precommercial thinning contracts. This will lessen the chance of root grafting and potential pathogen transmission. Use 25 feet as a spacing guideline in precommercial thinning.

P. Commercial thinning: Allow for adequate spacing between POC in commercial thinning contracts. Use 50 feet as a spacing guideline in commercial thinning sales. This will lessen the chance of root grafting and potential pathogen transmission.

Q. Thinning can also be designed so that POC is left in tight clusters 100 to 150 feet apart. The intent is to minimize the potential for root grafting between clusters of POC.

R. Endhauling/slide removal: Prior to removing soil and other material, determine is either the source of the destination of the material is infested with P. lat.

APPENDIX 1

SYNOPSIS OF REGIONS 5 AND 6 PORT-ORFORD-CEDAR COORDINATING GROUP ACTION PLAN

A. INVENTORY AND MONITORING

Goal: Develop a standard inventory and monitoring system for regional use.

Action items/objectives:

1. Inventory to establish POC locations.

2. Inventory to establish current boundaries of infection.

3. Monitor to establish the rate of spread, locally and species-wide.

4. Evaluate the effects of mitigating measures.

B. RESEARCH AND ADMINISTRATIVE STUDY

Goal: Develop a coordinated and prioritized approach to administrative studies and encourage research by other parties that is responsive to the management of POC.

Action items/objectives:

1. Test strategies of control for efficacy.

2. Encourage research units to initiate studies on identified research needs in the following priority:

   a. Develop methods to detect the pathogen in soil and water.

   b. Determine the requirements of the pathogen for survival and dispersal.

   c. Study measures to eliminate the fungus from areas of incipient infection.

   d. Investigate the existence of resistance to the pathogen within the range of POC.

   e. Determine to what extent genetic variation exists in POC.

C. PUBLIC INVOLVEMENT AND EDUCATION

Goals: Develop a coordinated regional effort to keep the public informed of the progress of POC management and incorporate public involvement in the process.

Action items/objectives:

1. Keep interested groups up-to-date on the progress of POC management.

2. Provide opportunities for interested groups and individuals to contribute to the coordinating team.

D. MANAGEMENT

Goals: Develop an agreed-upon and coordinated program to manage POC in the presence of root disease and generate criteria and mechanisms to determine the risk of spread.

Action items/objectives:

1. Continue to refine and update the risk assessment model used in evaluating projects.

2. Develop strategies for the management of the following activities:

    a. Timber sales

    b. Road construction and management

    c. Reforestation and stand management

    d. Other activities that have potential for earth-moving activities (such as quarry development) in stands containing POC.

3. Develop a system or method for sharing information.

APPENDIX 2

GENERAL SPECIFICATIONS FOR A WASHING STATION

Purpose: The purpose of the washing station is to remove as much soil and organic matter from vehicles as possible to prevent/reduce the spread of P. lat. Vehicles and equipment should be sanitized prior to entering uninfested areas and prior to departure from infested areas. The intent is to reduce the spread of P. lat. into uninfested areas. Sanitation can be accomplished with a mixture of chlorine bleach and water or by steam cleaning. The ration of chlorine bleach to water is 12 ounces of bleach per 1,000 gallons of wash water.

When locating and constructing a washing station to clean vehicles and equipment, we need to minimize the chance that a "clean" truck will be re-exposed to infested material near the washing site. There are two ways this can happen. One is if the truck travels through an area where "unclean" trucks are also traveling. This can be minimized by proper location of the washing station. If some common travelways are used, efforts need to be made that will reduce the chance of picking up soil. This can be accomplished by rocking the common road surface or hardening it in some other fashion. Reducing the amount of water used for dust abatement will lessen the amount of mud which may also prove useful.

The second way a "clean" truck could become a carrier again is by traveling through wash water and mud at the washing station. Proper construction of the site will eliminate this risk. Runoff of the wash water needs to drain away from the wash site and away from the travel route to and from the site. Wash water must not be allowed to drain into stream channels. The actual washing site needs to be elevated so that the trucks are not sitting in mud and wash water. This could be accomplished by ramps or by building a sufficiently high rocked surface on which the trucks can travel. The length of the rocked surface wash area should be at least 1.5 times the length of the trucks that will be using it. This will allow the trucks to travel on a non-contaminated surface for a short distance after being washed and reduce the chances of picking up infested soil from the washing. The gravel used for rocking should be of sufficient size to allow good percolation of water and soil into the subsurface. Accumulations of water and soil on the surface should be avoided. This last point also affects the depth of the rocked road surface. The amount of washing and the number of trucks using the site will also influence the depth.

The type of equipment used for washing needs to be sufficient to remove all soil and organic matter that is clinging to the trucks. The actual water pressure required can best be determined on the site. Each time a truck enters an uninfested site, it needs to be washed.

APPENDIX 3

EQUIPMENT CLEANING CHECKLIST

The purpose of this checklist is to provide guidance to contract administrators in the enforcement of equipment cleaning contract provisions for P. lat. control. This is a guide to direct administrators to specific areas on equipment that are likely to accumulate soil and should be check. Onsite judgments still need to be made about overall equipment cleanliness. This will be a new procedure form any purchasers and they need to be convinced of the seriousness of the situation prior to beginning the contract. Effective enforcement procedures (such as shutdowns) must be available to the contract administrator.

Does the equipment appear to have been cleaned?

Is the equipment clean of clumps of soil and organic matter?

RUBBER-TIRES VEHICLES	TRACK-LAYING VEHICLES
Tires Wheel Rims (underside and outside) Axles Fenders	Tracks Road Wheels Drive Gears Sprockets Roller Frame Track Rollers/Idlers
ALL VEHICLES AS APPROPRIATE Frame or Undercarriage Belly Pan (inside) Stabilizers (jack pads) Grapple and Arms Dozer Blade or Bucket and Arms Ripper Brush Rake Winch Shear Head Log Loader Water Tenders (empty or with treated water)	

APPENDIX 4

PROJECT ANALYSIS AND IMPLEMENTATION
(from the USFS POC Action Plan)

Threshold of Concern:

	RISK		
% of POC	Low	Medium	High
Low (0 to 5%)	No concern	No concern	High concern
Moderate (5 to 20%)	No concern	High concern	High concern
High (>20%)	High concern	High concern	High concern

Defining Risk:

Low	Below roads: No POC within 500 feet. Above roads: No POC within 50 feet.
Moderate	Below roads: POC may be within 100-500 feet of the road. Above roads: No POC within 50 feet.
High	Below roads: POC within 100 feet. Above roads: POC within 50 feet.

Objective A: Prevent/reduce the import of disease into uninfected areas.

Objective B. Prevent/reduce the export of disease to uninfected areas.

Objective C: Minimize increases in the level of inoculum or minimize the rate of spread in areas where the disease is endemic. If possible, identify the probable mechanism of spread; whether by introduction of spores or by root grafting.

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After extensive evaluation within the BLM, reviewers outside the agency were sought to provide additional commentary on the Port-Orford-Cedar Management Guidelines. These individuals conducted a comprehensive review of the document and contributed detailed responses.

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REFERENCES

Atzet, T.A. 1979. Description and classification of the forests of the upper Illinois River drainage of southwestern Oregon. Ph.D. Dissertation, Oregon State University, Corvallis. 211 p.

Atzet, T.A. 1993. Personal communication. Siskiyou National Forest, Grants Pass, OR.

Atzet, T.A. and L. McCrimmon. 1992. Preliminary Snag Distributions for the Port-Orford Cedar and Tanoak Series. USDA-FS, Siskiyou National Forest, unpublished data on file, Grants Pass, OR.

Atzet, T.A. and D.L. Wheeler. 1984. Preliminary Plant Associations of the Siskiyou Mountain Province. USDA-FS Pacific Northwest Region, Siskiyou National Forest, Grants Pass, OR. 315 p.

Bormann, F.H. 1996. The Structure, Function, and Ecological Significance of Root Grafts in Pinus strobus L. Ecological Monographs 36:1–26.

Brattain, D. and R.E. Stuntzer. 1994. The Port-Orford Cedar Alliance: A Response to the ONRC's Proposal to List POC. Smith River, CA. 144 p.

Cline, S.P. 1977. The Characteristics and Dynamics of Snags in Douglas-Fir Forests of the Oregon Coast Range. M.S. Thesis, Oregon State University, Corvallis. 106 p.

DeNitto, G. 1991. Evaluation of Sanitation of Port-Orford-cedar Along Grayback Road, Happy Camp Ranger District. USDA-FS, Pacific Southwest Region Technical Report N91-7. 3 p.

Denitto, G. and J.T. Kliejunas. 1991. First Report of Phytophthora lateralis on Pacific Yew. Plant Disease 75(9):968.

Edwards, S.W. 1983. Cenozoic History of Alaskan and Port-Orford Chamaecyparis Cedars. Ph.D. Dissertation, University of California, Berkeley, CA. 271 p.

Gee, E. 1993. Personal communication. USDA-FS Siskiyou National Forest, Gold Beach Ranger District, OR.

Gordon, D.E. 1974. The Importance of Root Grafting in the Spread of Phytophthora Root Rot in an Immature Stand of Port-Orford Cedar. M.S. Thesis, Oregon State University, Corvallis. 116 p.

Gordon, D.E. and L.F. Roth. 1976. Root Grafting of Port-Orford Cedar: An Infection Route for Root Rot. Forest Science 22(3):276–278.

Greenup, M. 1991–92a. Personal communications. USDA-FS Siskiyou National Forest, Grants Pass, OR.

Greenup, M. 1992b. Port-Orford Cedar Plan Status Report for Fiscal Year 1991. USDA-FS Siskiyou National Forest, Grants Pass, OR.

Hadfield, J.S., Goheen, D.J., Filip, G.M., Schmitt, C.L., and R.D. Harvey. 1986. Root Diseases in Oregon and Washington Conifers. USDA-FS Pacific Northwest Region, Forest Pest Management, Portland, OR.

Hansen, E.M. 1994. Personal communication. Oregon State University, Department of Botany and Plant Pathology, Corvallis, OR.

Hansen, E.M., Hamm, P.B., and L.F. Roth. 1989. Testing Port-Orford Cedar for Resistance to Phytophthora. Plant Disease 73:791–794.

Harlow, W.M. and E.S. Harrar. 1969. Textbook of Dendrology. Fifth Edition. McGraw-Hill, New York, NY. 512 p.

Hawk, G.M. 1977. A Comparative Study of Temperate Chamaecyparis Forests. Ph.D. Dissertation, Oregon State University, Corvallis, OR.

Jimerson, T.M., and R.M. Creasy. 1989. A Preliminary Classification for Port-Orford Cedar in Northwest California. USDA-FS Six Rivers National Forest, Eureka, CA.

Jimerson, T.M. and R.M. Creasy. 1991. Variation in Port-Orford Cedar Plant Communities Along Primary Environmental Gradients in Northwest California. USDA-FS, Six Rivers National Forest, Eureka, CA.

Kliejunas, J.T. 1991. Court Testimony, Northcoast Environmental Center and California Native Plant Society vs. Barbara Holder, F. Dale Robertson, USFS, Blue Lake Forest Products, Inc., and Murphy Creek Lumber Company; Civil #S-91-0078-EJG; United States District Court for the Eastern District of California.

Kliejunas, J.T. 1992. Personal communication. USDA-FS, San Francisco, CA.

Lang, Frank. 1992. Port-Orford Cedar: Nature Notes (transcript). Jefferson Public Radio, Ashland, OR.

Martinson, S. 1994. Personal communication. USDA-FS, Portland, OR.

Millar, C.I., Delaney, D.A., Westfall, R.D., Atzet, T., Greenup, M., and T.M. Jimerson. 1991. Ecological Factors as Indicators of Genetic Diversity in Port-Orford Cedar: Applications To Genetic Conservation. USDA-FS, Pacific Southwest Forest and Range Experiment Station, Berkeley, CA. 3 p.

Millar, C.I. and K.A. Marshall. 1991. Allozyme Variation of Port-Orford Cedar (Chamaecyparis lawsoniana): Implications for Genetic Conservation. Forest Science 37(4):1060–1077.

Ollivier, L.M. 1992. Habitat Relationships of Aquatic Amphibians in the Smith River Drainage. Master's Thesis, Humboldt State University, Arcata, CA. 155 p.

Ostrofsky, W.D., Pratt, R.G., and L.F. Roth. 1977. Detection of Phytophthora lateralis in Soil Organic Matter and Factors That Affect its Survival. Phytopathology 67:79–84.

Robison, G.E. and R.L. Beschta. 1990. Identifying Trees in Riparian Areas That Can Provide Coarse Woody Debris to Streams. Forest Science 36(3):790–801.

Roth, L.F., Harvey, R.D., and J.T. Kliejunas. 1987. Port-Orford Cedar Root Disease. Forest Pest Management Report Number 294. USDA-FS Pacific Northwest Range and Experiment Station, Portland, OR.

Schoeppach, W. 1991. Personal communication. USDA-FS Klamath National Forest, Happy Camp Ranger District, CA.

Thomas, J.W. and Raphael, M.G. 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment. The Report of the Forest Ecosystem Management Assessment Team, Portland, OR. 848 p.

Torgeson, D.C., Young, R.A., and J.A. Milbrath. 1954. Phytophthora Root Rot Diseases of Lawson Cypress and Other Ornamentals. Bulletin 537, Oregon State College Agricultural Experiment Station, Corvallis, OR. 18 p.

USDA-FS and USDI-BLM. 1994. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. Portland, OR. 1066 p.

Viets, R. 1993. Personal communication. USDI-BLM, Medford District, Medford, OR.

Zobel, D.B. 1979. Seed Production in Forests of Chamaecyparis lawsoniana. Canadian Journal of Forest Research 9:327–335.

Zobel, D.B. 1990. Chamaecyparis lawsoniana: Port-Orford Cedar. In: Burns, R.M., Honkala, B.H., technical coordinators. Silvics of North American: Volume 1, Conifers. USDA-FS Agricultural Handbook 654, Washington, D.C. 88–96 p.

Zobel, D.B., Roth, L.F., and Hawk, G.M. 1985. Ecology, Pathology, and Management of Port-Orford Cedar (Chamaecyparis lawsoniana). General Technical Report PNW-184, USDA-FS Pacific Northwest Range and Experiment Station. 161 p.

Appendix 2: Summary of Agency Actions for Fiscal Year 2001–2002 Under the Existing Direction for Port-Orford-Cedar

This information is presented to help guide assumptions about how the No-Action Alternative is expected to be implemented. Although the No-Action Alternative generally relies on site-specific analysis to select management actions from a menu of possible actions to meet an overall objective, a reasonable assumption about the future level and intensity of management actions can be made by examining what the Agencies have done under this direction in the past. The effects of the No-Action Alternative (Alternative 1) described in Chapter 3&4 and summarized in Chapter 2 are based in part on recent accomplishments noted in this appendix, and an expectation that a similar scope and intensity of management practices will continue.

Overview of Current Port-Orford-Cedar Program Implementation

In May 1987, and interregional Port-Orford-cedar (POC) Coordinating Group was formed by the BLM and FS. This group continues to serve as a programmatic technical coordination team composed of the BLM POC Coordinator, FS POC Manager, pathologists, ecologists, and geneticists, as well as administrative unit representatives from Oregon and California.

The existing POC program is basically made up of five efforts on the part of the Federal agencies: (1) decreasing the spread of the disease, (2) increasing the survival of the host, (3) producing valued by-products from its treatment, (4) considering potential impacts on other forest activities resulting from implementing *Phytophthera lateralis* (PL) mitigations, and (5) monitoring and communication.

1. Decreasing Spread of the Disease

A. Roadside Sanitation: The removal of roadside POC is a technique to prevent/reduce new infections along roads in currently uninfested areas, or if already infested, minimizing the amount of inoculum available to be transported to other uninfested road segments. Both agencies are currently using this tool in certain, site-specific forest projects. Treatment width varies in its application.

B. *Phytophthora lateralis* Eradication: By using a combination of treatments (such as removing the host, opening a stand to direct sunlight, using fire to lessen the amount of PL in soil, and planting different replacement species), PL may be eliminated from treatment areas eventually allowing POC to reestablish. Because its effectiveness has not been proven over the long term, neither agency is currently utilizing this technique.

C. Improve Roads to Decrease Risk, Especially within Key Habitats: Both agencies attempt to upgrade roads on a site-specific project basis to minimize movement of the pathogen on forest roads. Available funding, however, frequently limits this technique.

D. Water Sources: Water is frequently used in many forest activities, including road construction, dust abatement, and fire control. Water sources, however, may be contaminated with PL and the pathogen may be spread across the forest environment by the movement of water. Federal agencies have recommended and widely implemented treating such water with chlorine bleach and have largely mapped possible contaminated water sources within the range of POC. However, keeping maps of uninfested water sources current is not always possible with limited resources.

E. Road Design and Maintenance: Few forest roads are being built within the range of POC on Federal lands because of listed fish species and the decline in timber harvest levels. New road design specifications for sloping and surfacing have been implemented using recommended transportation management objectives when feasible. Existing Federal forest roads are continually being evaluated on a project basis for various treatments including upgrading surfacing, gating, or closing.

F. Road Use Restrictions: Although not always desirable or possible, closing or gating roads are effective methods for limiting the introduction of the disease.

G. Washing Vehicles: Even though washing can be a successful treatment for lessening the amount of PL spread across forest environments, it is difficult to apply efficiently. Realistic locations for installing washing stations are often not available, and control of use (who and when) is not always an option because of right-of-way permit requirements.

H. Restricting the Sale of Forest Products: Some administrative units have noticed a correlation between the sale and harvest of POC boughs and the spread of PL. These units have restricted or discontinued the sale of POC boughs.

2. Increasing Survival of the Host

A. Resistance Breeding: Based upon general forest resource management objectives to promote and sustain forest health, biodiversity, and productivity, the Forest Service (FS) and BLM have both committed time and funding to a resistance breeding program currently underway at the FS Dorena Genetics Resource Center located at Cottage Grove, Oregon. Related research is also being conducted at Oregon State University in Corvallis. A 5-year memorandum of understanding was recently signed between the two Agencies to continue interagency support for the POC breeding program (see additional details below).

B. Plant Spacing: Even though in the past, very few reforestation projects were done, wide spacing of POC seedlings became largely a moot consideration. But with large reforestation stock needs resulting from large fires such as the Biscuit Fire, seedling needs will increase. Individual POC seedlings are planted at a 25-foot spacing or in clusters 100- to 150-feet apart.

C. Precommercial and Commercial Thinning Spacing: Provisions of precommerical thinning contracts usually include requirements for leaving POC as leave trees whenever possible and creating wide distances between them. Federal commercial thinnings have also been implemented using recommended spacing guidelines, or have been used to remove POC growing adjacent to roads in or on the perimeter of treatment areas.

3. Producing Valued By-Products from Treatments

A. Bough Sales When Sanitizing: Harvesting boughs from POC trees that have already been cut during roadside sanitation treatments is currently being conducted only on the Medford District of the BLM.

B. Snag/Coarse Woody Debris Retention: Both agencies are following general snag and coarse woody debris retention direction of the "Northwest Forest Plan" (1994). POC is not specifically identified as a species targeted for retention.

C. Non-Port-Orford-Cedar Special Use Permits and Other Collections: Both Agencies issue and promote special use permits for the harvesting of other special forest products. Some examples include the sale of non-POC boughs, beargrass, and the collection of cones. The actual harvest of these commodities, however, sometime involves using forest roads during wet periods and, if not closely regulated, may take place in infested areas. Agency responses have typically been to prohibit special use permits on infested sites on a seasonal basis. It should be noted that noncompliance of the conditions of the special use permits and limited law enforcement abilities or contract oversight frequently allow the opportunity for spread of PL on forest roads. Aggregate material is also routinely sold by both agencies, sometimes where the material may be contaminated with PL.

4. Potential Impacts on Other Forest Activities Resulting from Implementing *Phytophthora lateralis* Mitigations

A. Mining: Activities likely to cause significant disturbance of surface resources require a plan of operation, leading to Agency requirements for reasonable terms and conditions. Mining operators can be required to follow the same mitigation techniques as the Agencies require of themselves, contractors, and permittees.

B. Incorporating Port-Orford-Cedar Concerns When Planning Other Projects: The geographic information system is the basic planning tool used for identifying currently known locations of both POC and PL in relation to proposed project locations. Other ongoing programs, such as the issuance of special use permits, consider these actions and the possible spread of the disease. POC concerns are also identified in agency transportation management plans and are considered in relation to possible road management activities, including road construction, maintenance, and use.

5. Monitoring/Education

A. Monitoring: Within the FS, implementation and effectiveness monitoring of POC projects are conducted in accordance with respective land and resource management plans. Elements of FS monitoring programs may include conducting annual surveys for identifying new locations of POC root disease, estimating overall trends of rates of spread of the disease, evaluating the risk of spread for proposed projects and follow-up after project completion, and collecting data to estimate intensity of infested areas. For the three BLM districts, resource management plans require all projects to conform to the "Port-Orford-Cedar Management Guidelines" (1994). These Guidelines state that when inventorying POC and PL areas, effectiveness of management of the pathogen and disease control should be monitored for at least 5 years in the drier portion of the range of POC and for longer periods where climatic conditions are wetter. Both agencies have sometimes not met timing recommendations for reinventorying locations of POC and PL.

B. Public Education: The FS and BLM have prepared a POC communication plan. The plan identifies specific methods for possible education efforts including press releases, posters and pamphlets; public field tours; presentations to user groups; a POC Newsletter; coordination with Tribal groups; creating POC internet websites; conducting public symposiums; preparing and installing information signs on trailheads, gates, and other closures; holding coordination meetings with industrial and small woodland landowners; and supplying maps of road closures. Actual implementation of these tasks varied widely depending on available staff time, budget, or legal constraints.

Existing Programmatic Actions

Interagency Port-Orford-Cedar Breeding Program

The FS and BLM are supporting an ongoing program at the FS Dorena Genetic Resource Center, Cottage Grove, Oregon, to identify the amount and type of genetic resistance in natural populations of POC to the introduced PL pathogen. Wild, individual trees are selected to test for genetic resistance, with the goal to produce resistant seed to restore and sustain POC and its function in the ecosystem. Users of this seed are currently limited to Federal and cooperating agencies, although there is obviously a demand from the private sector.

With assistance from Oregon State University, work is continuing to develop durable resistance (that is to survive long term) while retaining the broad genetic diversity within the species. Over 11,000 field selections throughout the POC range have been made. Using a stem inoculation technique, vegetative material collected from these trees have been screened for resistance to PL; these same trees are now being retested using a root inoculation technique to help validate and refine the initial screening.

Other elements of the POC program involve propagation; growing, cultivating, and maintaining containerized trees; breeding; seed production; evaluation using validation plots; analysis; data management; record keeping; and technology transfer.

Because POC bears cones at age 4 or 5, the program is advancing quickly. In the fall of 2002 the first large cone crop was collected from resistant nursery stock and the opportunity now exists to use this seed in some breeding zones. Resistant seed is being sown in early 2003 to be used to restore areas burned in the Biscuit Fire on the Siskiyou National Forest (NF).

Agency Wildfire Management Implications

Firefighting activities have commonly involved the use of water for suppression purposes and the use of vehicles to transport people and equipment within and around the fire perimeter. Prior to the fire season, the FS and BLM have both inventoried and updated possible water sources and have identified potentially infested water sources. When a wildfire breaks out, this information has been communicated to fire resource advisors and, when safely possible, the use of either uninfested or treated water has been encouraged. If present, propagules of the pathogen have be killed in contaminated water by treating it with chlorine bleach. Frequent and strategic washings of fire vehicles and equipment have also been recommended.

Updating Mapping of Port-Orford-Cedar/*Phytophthora lateralis* Locations

From 1990 to 1996, the FS and BLM took up the substantial task of initially mapping range-wide on federally-administered lands with known and recently observed locations of both POC and PL. Utilizing existing data, road surveys, aerial photo interpretation, and annual aerial surveys, maps were compiled and transferred to the geographic information system and are now available at both the administrative-unit and range-wide scale. In Fiscal Years 2001 and 2002, changes have been noted and geographic information system layers have been revised as needed. This spatial and temporal information is now routinely used for project planning.

Specific Actions by Administrative Unit

Siskiyou National Forest. The Siskiyou NF recently issued a POC policy that recommended to employees, contractors, and the general public, when in areas within the range of POC, to use a range of mitigation actions to reduce the risk of import, export, or spread of PL. Actions recommended included washing vehicles prior to entering any areas of uninfected POC on NF lands, avoiding use of roads closed or gated for POC protection, and cleaning footwear when work is completed in infested areas.

In Fiscal Year 2001, the Siskiyou NF reported programmatic funding of approximately $238,000 for a POC manager to serve all NFs within the range of POC, as well as district or zone POC coordinators, printed educational materials, and other supplies.

The Forest tracks individual projects that were active within the range of POC and, by each respective activity, reports implementation of disease control efforts and their success in discouraging the spread of the disease. Broad categories used are engineering and road management, timber harvest, and stand management actions.

Firefighting operations on the Biscuit Fire that occurred on the NF in the summer of 2002 included efforts to minimize spread of the root disease. Management actions taken, when safely possible, included daily washing of vehicles and equipment, and treating water with chlorine bleach. Approximately 9,900 gallons of chorine bleach were used on the fire.

Six Rivers National Forest. A biannual aerial detection flight conducted in Fiscal Year 2001 discovered a new root disease location and the road was closed and access restricted. No other new infections were reported.

In Fiscal Year 2002, the Six Rivers NF conducted a presuppression assessment ($20,000), closed a road, built a trail and moved a trail, and conducted surveys to move other trails into three natural resource areas ($32,310), and removed POC growing alongside forest roads ($8,000).

The Six Rivers NF also has a common-garden site located at the Humboldt Nursery facility, and the Forest has actively relocated trails and trailheads because of PL concerns, instituted an active roadside sanitation program, installed a wash station at Orleans, California, developed a public education program, and installed and maintained POC resistance trails at two sites.

As on the Siskiyou NF, firefighting operations on the Biscuit Fire that occurred in 2002 included efforts to minimize spread of the root disease. Management actions taken, when safely possible, included daily washing of vehicles and equipment, and treating water with chlorine bleach.

Shasta-Trinity National Forest. POC root disease was confirmed to be on the Shasta-Trinity NF in 2001. The Forest incorporates POC management considerations into all of its management activities. Eradication treatments are scheduled to take place in 2003. Routine actions, when vegetation management is practiced where POC occurs, include detections, evaluation, and control of pest-caused damage. As an example, in Fiscal Year 2002, the Forest relocated and improved many road crossings ($20,400) as part of an active program to identify and address sites that are at high risk for introduction of PL. The Cedar Basin Research Natural Area is also actively managed to exclude the pathogen—inland POC populations there are genetically and ecologically distinct from coastal populations.

A large common-garden site on the Shasta-Trinity NF near Weaverville, California, is maintained and evaluated by the Forest to determine the physiological and genetic variation traits of the species.

Klamath National Forest. PL does not currently occur on lands administered by the Klamath NF, although there are many stands of POC. In Fiscal Year 2002, the Klamath NF provided $4,000 for field collections of vegetative material in support of the POC genetics program. The Klamath NF instituted and maintains roadside sanitation zones along Grayback Road and other areas, maintains an active disease monitoring program, and incorporates POC management considerations into all of its management activities.

Coos Bay BLM. Because the disease has been present on these federally-administered lands for the longest period of time (50 years) and its presence is pervasive across the Coos Bay District, effectively controlling the spread of the disease is especially difficult. Also, because of the BLM's system of existing reciprocal right-of-way agreements with private parties, road treatments and control are often not possible. The Coos Bay District implemented some road treatments in Fiscal Year 2001 which included roadside sanitation when practical, washing of vehicles (seasonally), closing selected roads, summer hauling on dirt roads, and prohibiting the cutting of POC boughs.

Because the disease has been present in this location for a long period of time, individual wild trees have also had the greatest opportunity to express genetic resistance (usually indicated by healthy POC surrounded by dead or dying POC). A large number of such trees from this District have tested positively for resistance and are now represented in the genetics program.

It is estimated that 80 percent of all green, living POC trees on the Coos Bay District are scattered and well-distributed away from streams and roads where mitigation measures are not needed. In these areas of low risk for infection, POC trees are expected to maintain their population. The District planted 2,000 non-resistant, POC seedlings on acres of low-risk sites in Fiscal Year 2001 and 1,000 non-resistant, POC seedlings on 150 acres of low-risk sites in Fiscal Year 2002.

Medford BLM. Management for POC during Fiscal Year 2001 and 2002 on the Medford District BLM fell into two broad categories. The first category involved the collection of information, monitoring of sites infested with PL and its spread, and the continuation of efforts involving resistance to the root disease represented by selecting and testing individual POC trees.

The second category of POC management was the physical management of stands. Projects included treatments such as roadside treatments that removed POC, pre-commercial thinning treatments where POC was thinned to a wide spacing to reduce the spread of the root disease through root grafts, restrictions (such as seasonal gates), limited bough collection from uninfested areas, and the creation of POC snags. Other projects, such as trail construction, were designed to avoid POC locations.

Roseburg BLM. The Roseburg District continues to implement a series of management actions including washing vehicles and seasonal-use restrictions on certain roads, and prohibiting such activities as bough collecting at certain times of the year.

In Fiscal Year 2001, other associated District programs included an active program of mapping new locations of the disease, removal of hosts next to roads, continued identification of genetically resistant trees, and pursuing a proposed land exchange that would protect a serpentine plant community with POC.

In 1997, a 10-acre site on the District was planted to study POC range-wide silvicultural and genetic characteristics. The site is continually maintained and the POC, which originated from varying locales from Oregon and California, are being evaluated.

Appendix 3: Port-Orford-Cedar Standards and Guidelines in the Land and Resource Management Plans in Region 5, SEIS Cooperating Agencies, and the Siuslaw National Forest

Existing Direction — Six Rivers National Forest

The following is from the "Six Rivers National Forest Land and Resource Management Plan" (1995).

TREES WITH SPECIAL MANAGEMENT CONSIDERATION

[Page II-7] Strategies for reducing the risk of infection or spread of the disease will be integrated into all levels of planning and analysis for all areas that contain Port-Orford-cedar (POC). A risk analysis will be completed for all projects in watersheds containing POC. The Forest is utilizing disease control strategies.

[Page III-16] POC will be managed according to the Forest plan Standards and Guidelines that should provide an opportunity to prevent the spread of the root disease. Opportunities may occur to reestablish POC in plant associations which have been altered by root disease.

[Page III-16] The Forest Service implements an integrated pest management approach to dealing with forest pests (such as root diseases) which includes prevention, detection, evaluation, suppression, and monitoring. Pest management goals are directed toward reducing pest-related losses to levels that maintain a healthy forest environment.

<u>Standards and Guidelines</u>

[Page IV-51] *Pest Management*

1. No management action should be taken against endemic insects or Forest pathogens unless it can be determined that their occurrence has been exacerbated by human activities or spread would significantly compromise the integrity of the [Special Interest Area].

2. In order to reduce the spread of POC root disease, a risk analysis will be completed for all projects in watershed containing POC.

3. Access and/or projects proposed in uninfected watersheds which have potential risk for infection shall have a risk analysis performed.

Transportation and Facilities

[Page IV-53] 7. To prevent the introduction of POC root disease into uninfested areas of the North Fork Smith River Botanical Area, close Road 18N13 to vehicle access. Vehicle access into remaining areas (Road 18N09 and associated spur roads) is prohibited pursuant to 36 CFR 261.50; the prohibition exempts officials pursuant to 36 CFR 261.50(d)(4) and persons with a permit, special-use authorization, or operating plan, as defined in 36 CFR 261.2, issued by the District Ranger or higher-ranked authorized official. Access shall not be allowed during the wet season and during periods of heavy rain in the summer. If monitoring determines that these measures are not effective, additional mitigation measures will be considered and analyzed.

MANAGEMENT AREA 11-SPECIAL REGENERATION

Pest Management

[Page IV-54] 1. In order to reduce the spread of POC root disease, a risk analysis will be completed for all projects in watersheds containing POC.

FOREST-WIDE DIRECTION — PEST MANAGEMENT

Pest Management Program

[Page IV-129] *Goals:* Minimize resource damage from insects, disease, plants, and animals to help achieve resource objectives. Where this damage causes undesirable changes in vegetation, minimize resource damage through integrated pest management.

Direction: Of special concern to this Forest is POC root disease, *Phytophthora lateralis*. Special practices and monitoring are being implemented to maintain the viability of POC in the forest for genetic diversity, as well as economic and American Indian contemporary uses. Management is intended to be site specific, consistent, and visible to the public. Any activity that has a potential for spreading the root diseases fungus will require a formal analysis and prescription for controlling the spread of the fungus. This process is also required when Pacific yew is intermingled with POC or within the same project area as POC.

Port-Orford-cedar Root Disease

20-6: POC will be managed as a long-term component of plant associations where it is present.

20-7: Strategies for reducing the risk to POC from infection of the root disease will be integrated into all levels of planning and analysis (NEPA documents, watershed analysis, late-successional reserve assessments, wild and scenic river management plans, transportation planning, recreation planning and other activities or strategies) in all watersheds where it is present.

Transportation plans will evaluate the risk of spread of POC root disease through road upgrades, seasonal closures, permanent closures, maintenance, and decommissioning or obliteration.

Recreation plans will also evaluate the risk to POC and address access, trail, and road use for recreational purposes.

20-8: In order to reduce the spread of POC root disease, a risk analysis will be completed for all projects in watersheds containing POC. Disease control strategies identified from experience and research will be applied on a site- or drainage-specific basis to prevent or if the disease is present, reduce the spread and severity of the disease.

[Page IV-130] 20-9: Information concerning POC root disease, its spread and prevention, will be provided to the public.

20-10: Proactive disease prevention measures such as road closures, road maintenance, and sanitation removal of roadside POC will be undertaken to help prevent the spread of the disease, especially to high risk areas. Prevention measures would be identified at a site-specific or drainage-specific level through environmental analysis.

IMPLEMENTATION, MONITORING, EVALUATION, & AMENDMENT

Forest Pests & Diseases

[Page V-20] *Effectiveness monitoring questions:* Are applicable mitigations and management strategies preventing/minimizing significant damage or growth reductions from destructive insects or diseased on the Forest, including POC root disease?

Sampling methods and intensity: (1) Routine sampling during stand exams and reforestation surveys;

and (2) biannual aerial detection surveys, plus intensive sampling of road systems infected by POC root disease.

Threshold of concern and responsible staff: (1) Pathogen or pest levels indicate potential for damage or growth loss in 15 percent of samples; (2) detected acceleration of POC root disease spread; and (3) SO and District silviculturists.

APPENDIX H

Pests: Port-Orford-cedar:

[Page H-9] *Monitoring purposes:* (1) Determine infected locations, rates of spread and overall trends of POC root disease; and (2) evaluate effectiveness of strategies to control spread of the disease.

Threshold of concern/Variability: Measured acceleration or deceleration of spread as an indicator of positive or negative effectiveness of control strategies.

Data collection: Conduct aerial photographic inventories to identify healthy and diseased stands. Intensively sample infected road systems to determine the extent and rate of spread of POC root disease along transportation routes. Regularly schedules reforestation surveys after the first, third, and fifth growing seasons will indicate performance in plantations. Perform aerial detection surveys at least every two years to indicate spread along streams and roads and within forest stands. Research will be initiated to measure genetic diversity, develop disease-resistant trees, and evaluate methods of control.

Responsibility: Forest ecologist and Forest and District silviculturists.

APPENDIX K – PORT-ORFORD-CEDAR ACTION PLAN

[Page K-4] Control Strategy—Project analysis and Implementation

The following is an outline format to be used to complete a risk analysis for all projects in watersheds containing POC. Disease control strategies will be applied as appropriate on a site or drainage-specific basis to reduce the spread and severity of the disease.

		Risk (concern)		
	% of POC	Low	Moderate	High
IMPACT	Low (0–5)	Low	Low	High
	Moderate (5–20)	Low	High	High
	High (>20)	High	High	High

Defining Risk

Low—Below roads, no POC within 500 feet; above roads, no POC within 50 feet.

Moderate—Below roads, POC may be between 100 and 500 feet of the road; above road, no POC within 50 feet.

High—Below roads, POC within 100 feet; above roads, POC within 50 feet.

Potential Project Objectives

Objective A: Prevent the import of disease into uninfected areas (offsite spores picked up and carried into uninfected project area).

Objective B: Prevent the export of disease to uninfected areas (onsite spores moved to offsite uninfected area).

Objective C: Minimize increases in the level of inoculum or minimize the rate of spread in areas where the disease is endemic or infection is intermittent. If possible identify the probable mechanism of spread; whether by introduction of spores or by root grafting.

Threshold of Concern Assessment

The assessment will discuss the level of concern regarding the project, the causes for concern, specific areas of concern and possible treatments to preclude the level of risk. The following is a list of possible treatments.

Disease Control Strategies

Engineering and Road Management [E]

E-1: Road locations should be made, when possible, below cedar areas or on opposite sides of ridges.

E-2: Control drainage from roads so that it is dispersed to the maximum extent feasible through outsloping and/or frequent ditch relief. Where not feasible, drainage should be concentrated into existing stream channels.

E-3: Locate and design waste areas so they do not spread infection spores.

E-4: Limit road construction to the dry season.

E-5: Machinery and vehicles working and traveling on road prior to establishment of final drainage need to be washed before entering project.

E-5A: Machinery and vehicles working and traveling on road prior to establishment of final drainage need to be washed before entering project. Trucks end-hauling material to waste areas may be exempted provided no infected toads or sites are traveled between the project and the waste area.

E-6: Wash equipment before leaving infected areas.

E-7: Close roads with guardrails, physical blockages or "putting to bed". Maintenance and enforcement is included.

E-7A: Close roads with guardrails, physical blockades or "putting to bed" in order to restrict product utilization and management activities in the dry season (June 1 through September 30). Maintenance and enforcement are included.

E-8: Avoid dust abatement with potentially infected water or treat water with chlorine.

E-8A: Avoid dust abatement and compaction with potentially infected water or treat water with chlorine.

E-9: Maintenance activities should avoid spilling rock on outside or downslope side of the road. As needed, blading shall be kept within 2 feet of the road edge to better achieve this.

E-10: Where conditions permit, inslope the road template and establish berm on the outside edge of the road to prevent downslope flow of contaminated water.

E-10A: For maintenance purposes, where conditions permit, establish berm on the outside edge of road to prevent downslope flow of contaminated water.

E-11: Establish road rules to prevent timber haul during periods when spores will be spread widely.

E-12: Dump fill and debris from infested culverts and ditches in safe areas to avoid spreading the fungus.

E-13: Establish road surface blading requirements to maintain a specified road template during maintenance operations.

Timber Harvest [T]

T-1: Limit the operating season of timber sale operations to the drier months.

T-1A: Limit the operating season of timber sale operations to the drier months (June 1 to September 30); discontinue operations during periods of rain or wet weather (C6.315: Limited Operating Season).

T-2: Wash logging equipment before operating away from landings and roads.

T-3: Constrain timber haul so trucks do not travel from infected areas, contaminating the latter. Harvest the units in priority order to minimize the spread of spores to uninfected areas.

T-4: When feasible, plan downhill logging to avoid road construction above uninfected stand.

T-5: Use helicopter logging to protect high value cedar stands.

T-6: Use service contracts to harvest timber with more control of activities.

T-7: Wash logging equipment working in infested sites before it is moved off site.

T-8: Wash logging equipment, other than log trucks, prior to entering sale area.

T-9: Wash log trucks and other equipment when moving from infected to uninfected areas during wet weather.

Stand Management [S]

S-1: Identify low risk areas and emphasize maintaining and/or introducing POC into the species mix.

S-2: Plant POC singly or in groups at a wide-spacing independent of other stocking.

S-3: Avoid planting POC within 50 feet of roads, streams, or wet areas.

S-4: During precommercial thinning [PCT] thin POC at a 25 foot spacing, independent of other crop trees, or space POC in groups 100 feet apart were possible.

S-5: As part of PCT, remove POC from areas adjacent to roads, streams, and other high risk areas.

S-6: To insure the presence of POC through the rotation, leave all thrift cedar during commercial thinning.

S-7: Manage the cedar component of the stand on a longer rotation than the other associated conifers. Example: carry cedar through two or three fir rotations.

S-8: Plant container grown POC until bare root stock can be certified disease free at the nursery.

S-9: Indicate in stand records (TRI, etc.) that POC protection measures have been implemented.

S-10: Minimize management entries during wet meadow. Wash vehicles when such entries are made. Must be associated with formal road closure.

S-11: Where possible coordinate prevention/control activities with adjacent private landowners.

Other [O]

O-1: Administrative closure orders.

O-2: Coordinate other products utilizations with POC control needs and road closures. Examples: fuelwood cutting, cedar bough cutting.

POC Cumulative Effects Analysis

[Page K-7] Each project analysis will contain a discussion of potential cumulative effects. The assessment will use the following definitions and will use the analysis chart to help determine whether there are potential secondary or cumulative effects.

Definitions

Meaningful quantities of POC: Use 5 percent or greater cover. Consider and identify exceptional situations where less than 5 percent can be meaningful, such as small isolated stands near the edge of the species range.

Downslope/downstream: Consider all the forest land areas between the analysis area and the first occurrence of the root disease. If a proposed activity occurs on a ridgetop then analyze both drainages.

Introducing risk: Estimate the percent of the analysis area in which the risk of infection is increased as a result of the proposed management activity.

Meaningful levels of mortality: This is defined as a mortality rate of 25 percent of existing POC over the next 20 year period.

Cumulative Effects Analysis Chart	
Meaningful quantities of POC within or downslope/downstream of the analysis area? If yes, continue.	If no, then no secondary or cumulative effect.
Will the proposed project introduce risk to this cedar? If yes, continue.	If no, then no secondary or cumulative effect.
Following mitigation, is disease likely to infect a major amount of the analysis area?[1] [Ref: 40 CFR 1508.27] If yes, then there are potential secondary and cumulative effects.	If no, then no secondary or cumulative effect.

[1] Major is a relative term; it means great or large in relative importance to POC existence in the near proximity and over its range, notable or conspicuous in effect or scope (for instance, visually detracting), or poses a serious risk to the ecosystem, its neighbor POC, and the total population.

Existing Direction — Klamath National Forest

The following is from the "Klamath National Forest Land and Resource Management Plan" (1995).

Desired Future Condition of the Forest

The Forest in 10 Years

[Page 4-16] Management activities would be promoted than increase the populations of desirable plant species with limited distributions or low population levels. Species of concern include Brewer spruce, POC, Pacific yew, and sugar pine.

Standards and Guidelines

Biological Diversity

[Page 4-23] 6-13: Management activities should be designed to maintain or increase population levels of desirable native plant species that currently have low population levels, of desirable plant species with limited habitat distribution and of desirable plant species that have problems with disease. Examples include POC, sugar pine, Pacific yew, Brewer spruce, etc.

[Page 4-24] 6-15: All vegetative management practices should be designed to maintain a healthy forest. Conditions that promote the introduction and spread of disease, increase the risk of insect attack or promote unacceptable fire risk should be avoided.

Transportation and Facilities Management

[Page 4-51] 20-1: Transportation Planning analysis should: (4) Evaluate the risk of spread of POC root disease through road upgrades, seasonal closures, permanent closures, maintenance and decommissioning or obliteration.

Timber Management

[Page 4-59] 21-57: Maintain a healthy and resilient population of all species, including special interest species such as Pacific yew, brewer spruce, POC, Pacific silver fir, Baker cypress, and whitebark pine throughout their native range.

1. Projects with the potential to impact special interest species should be analyzed and the potential impacts documented through the EA process.

2. Mitigation for impacts should include provisions for planting or increasing local populations where desirable.

[Page 4-60] 21-61: Take measures that shall limit the spread of POC root rot, and increase populations of POC on the Forest. Prevent or reduce the risk of introducing the disease into uninfested areas. Strategies for reducing the risk to POC from infection by the root disease will be integrated into all levels of planning (NEPA documents, ecosystem analysis, LSR assessments, WSR management plans, transportation plans, recreation and other activities or strategies).

In order to reduce the spread of POC root disease, a risk analysis will be completed for all projects in watersheds containing POC. Disease control strategies identified from experience and research will be applied on a site or drainage-specific basis to reduce the spread and severity of the disease.

Existing Direction — Shasta-Trinity National Forest

The following is from the "Shasta-Trinity National Forests Land and Resource Management Plan" (1995).

CHAPTER 4, STANDARDS AND GUIDELINES

[Page 4-18] 10. Forest Pests

a. When conducting watershed/ecosystem analysis, consider the possible effects that Forest pests may have on management objectives and desired future conditions.

b. Implement an integrated pest management (IPM) program to maintain or reduce forest pest impacts to acceptable levels and to maintain or enhance forest health and vigor. Any decision to use pesticides will require site specific environmental analysis.

e. Take measures that limit the spread of POC root disease.

SUPPLEMENTAL MANAGEMENT AREA (MA) DIRECTION

[Page 4-102] MA 5 - Parks-Eddy: (16) Perform a POC risk analysis for any planned management activities in areas with that species. Implement appropriate mitigation measures to prevent the introduction of *Phytophthora lateralis* the cause of POC root disease.

[Page 4-105] MA 6 - Upper Trinity: (4) Perform a POC risk analysis for any planned management activities in areas with that species. Implement appropriate mitigation measures to prevent the introduction of *Phytophthora lateralis* the cause of POC root disease.

[Page 4-109] MA 7 - Weaverville/Lewiston: (3) Perform a POC risk analysis for any planned management activities in areas with that species. Implement appropriate mitigation measures to prevent the introduction of *Phytophthora lateralis* the cause of POC root disease.

[Page 4-115] MA 8 - Trinity Unit: (5) Perform a POC risk analysis for any planned management activities in areas with that species. Implement appropriate mitigation measures to prevent the introduction of *Phytophthora lateralis* the cause of POC root disease.

[Page 5-9] TABLE 5-1: MONITORING ACTION PLAN

Forest Pests

Activity, Practice or Effect: Forest pest activity levels (especially where they conflict with management objectives)

Techniques and/or Data Sources: Review project level plans for inclusion of possible pest effects

Intensity and Standard: Regional standards; selected project plans

Frequency of Measurement/Reporting: Annually, as changes occur

Expected Precision/Reliability: High

Variability in Standard Which Would Require Further Evaluation and/or Corrective Action: > 10 percent of project plans fail to consider pests

APPENDIX L, DESCRIPTION OF MANAGEMENT PRACTICES

[Page L-3] Integrated Pest Management

The decision-making process considers the ecology of the host and its pests throughout the rotation of the forests. It also considers management objectives and economic values of the resource, couples with monitoring data on pest populations and environmental factors that favor their increase. These data are required to decide for or against action to reduce excessive losses to the resource.

Action alternatives may be oriented toward prevention of losses or they may be in directs response to chronic or catastrophic losses. One or more approaches may be used. These approaches emphasize retention of natural system and include cultural, mechanical, biological, regulatory, and chemical tactics. A no-action alternative may also be appropriate.

Existing Direction — Siuslaw National Forest

The following is from the "Siuslaw National Forest Land and Resource Management Plan" (1990).

FOREST-WIDE STANDARDS AND GUIDELINES

[Page IV-58] FW-179: Pest Management - Use an Integrated Pest Management (IPM) approach, which recognizes pest management as an integral part of timber and other resource management, to prevent and reduce unacceptable pest-related damage. Under IPM, consider and analyze a full range of pest management alternatives, including cultural, biological, chemical, and mechanical methods, on a site-specific, project-level basis. Select specific treatment methods through an environmental analysis process which will consider environmental effects, treatment efficacy, and cost of each alternative on a case-by-case basis. Set up monitoring and enforcement plans to implement specific measures during this site- and project-specific analysis.

OREGON DUNES NATIONAL RECREATION AREA (NRA) MANAGEMENT PLAN, Amendment to the Siuslaw Forest Plan (1994).

Management of Habitats

[Page III-10] Plants – Management of plant habitats will be focused on globally significant communities included in Management Area [MA] 10(F), plants that are listed as sensitive, and native plant communities associated with the active-dune ecosystem. Management in globally significant communities will focus primarily on maintenance and protection and development of plant-based learning opportunities. Globally significant communities currently within MA 10(F) include:

Port Orford cedar/evergreen huckleberry community.

[Page III-42] Management Area 10(F) – Plant, Fish and Wildlife Habitats

Goals – To maintain, create, enhance or restore a variety of special plant, fish and wildlife habitats.

Desired Condition – Optimum physical and biological conditions necessary for target plant, fish or wildlife communities are present. Diverse habitats of various sizes are dispersed across the Oregon Dunes NRA. Even though management activities have taken place, the area is predominantly natural appearing. Human use and disturbance is low. There is an absence of ORVs (other than for administrative uses) and incompatible behaviors such as disturbing animals or harvesting plants. There are few trails or other facilities.

Following are descriptions of the desired condition for the specific components of this management area:

Forest Habitats – Forest stands have multiple vegetation layers except in communities where this would not naturally occur. Where present, the shrub layer is relatively undisturbed. Different plant communities and tree age groups are spread throughout the management area. Snags and down logs are present in numbers expected to occur naturally. There is an abundance of mushrooms and other decomposers.

Appendix 4: Clorox Use, Toxicity, Potential Environmental Effects, and Label Information

Introduction and Use

Ultra Clorox® Brand Regular Bleach (EPA Reg. No. 5813-50) is registered for POC root disease treatment use. The active ingredient in Ultra Clorox® is sodium hypochlorite. When used as directed, it is effective in killing PL in treated water. As described in other sections of this SEIS and suggested in the standards and guidelines of some of the alternatives, treating water prior to use helps control the spread of PL to uninfested areas. Water is commonly drafted from streams and fire ponds within forested areas to use in dust abatement on forest roads, equipment cleaning, and for fire suppression.

Label instructions (see Appendix 4) specify 1 gallon of Ultra Clorox to 1,000 gallons (~50 parts per million available chlorine) of drafted water. Prepare the mixture at least 5 minutes prior to application for dust abatement, fire suppression, and cleaning trucks, logging, road-building, and maintenance equipment.

This label has been in effect since March 5, 2001. The Biscuit Fire on the Siskiyou NF in 2002 burned 500,000 acres including 95,000 acres of POC. Suppression activities lasted over 4 months and restoration activities followed. Approximately 9,900 gallons of Ultra Clorox were used in accordance with the label to treat water used on the fire and to clean suppression equipment. Such uses would be projected to continue under the current direction.

Vehicle and other washing stations are always located where direct runoff will not enter streams. Water spread on roads or dropped onto fires develops into a fine to moderate spray in the air, and spreads on contact. Sodium hypochlorite is a strong oxidizing agent and quickly breaks down on contact with organic matter. Decomposition takes place within seconds in the presence of ammonium salts (National Fire Protection Association 1986).

Toxicity and Potential Environmental Effects

In 1986, based upon available data on Clorox's chemistry, toxicity, environmental fate, and ecological effects, the U.S. Environmental Protection Agency (EPA) concluded that any hazards associated its uses were relatively small (Chemical Fact Sheet 1986). Toxicity characteristics of Clorox were identified as follows:

Mallard duck	5,220 parts per million
Quail	5,620 parts per million
Rainbow trout	0.18 – 0.22 milligrams/liter
Daphnia	0.033 – 0.048 milligrams/liter

In 1991, the EPA determined that human risks from chronic and subchronic exposure to low levels of Clorox were minimal and without consequence to human health. Upon reevaluating the 1986 data, they also reaffirmed that currently registered uses of Clorox would not result in unreasonable adverse effects to the environment. The EPA also stated they believed that the risk of acute exposure to aquatic organisms was sufficiently mitigated by, in part, its precautionary labeling (EPA 1991).

Sodium hypochlorite is highly toxic to aquatic organisms. The freshwater criteria for the protection of most aquatic species and their uses are 11 micro g/L TRC [total residual chlorine] as a 4-day average (0.011 parts per million) and 19 micro g/L as a 1-hour average (EPA 1984). Research into the control of zebra mussels (Dreissena polymorpha) showed it was an effective biocide at concentrations of 1 mg/L (1 parts per million) (Martin et al. 1993). Rainbow trout (Salmo gairdneri) exposed to a 30-minute dose showed an LC50 value of 0.43 mg/L at 20 C (0.43 parts per million) while triple exposures for 5 minutes resulted in a LC50 of 1.65 mg/L (Brooks and Seegert 1977).

Non-human mammalian toxicity values are LD50 Rat oral 8.91 g/kg (Department of Transportation-U.S. Coast Guard 1984) and LD50 Mouse oral 5,800 mg/kg (Lewis 1996). There is inadequate evidence for the carcinogenicity of hypochlorite salts (IARC 1991).

Alternatives 1, 2, and 3

Use will continue at approximately existing rates, although 2002 was an unusually heavy fire year in the range of POC. Average annual fire use should be no more than 1,000 to 2,000 gallons, with other uses less than that.

Use of Ultra Clorox® for water decontamination will not result in aquatic exposure if it is applied in accordance with label instructions. When used in water dropped from helicopters, dropping directly into visible water sources is avoided. Drops into smaller wet areas may happen, but water drops are generally only made directly on actively burning spots, so localized effects of dropping treated water is expected to be outweighed by the benefits of reducing the fire intensity. Water errantly dropped on somewhat larger streams may take yards or tens of yards to dilute to sub-toxicity levels, but again these drops occur in areas in the process of being burned.

Ultra Clorox® can cause severe but temporary eye irritation and can be a skin irritant (U.S. Coast Guard, Department of Transportation 1984). Use of the appropriate personnal protective equipment by those preparing the Ultra Clorox® treated water will avoid accidental exposure from splash to eyes or skin.

Alternatives 4 and 5

There are no POC management measures applied under these alternatives that would use Clorox.

Clorox Label Information

The following information copied verbatim from the Clorox label is pertinent to Port-Orford-cedar root disease control.

ULTRA CLOROX® BRAND REGULAR BLEACH (EPA Reg. No. 5813-50)
FOR PORT ORFORD CEDAR ROOT DISEASE (*Phytophthora lateralis*) TREATMENT USE

When used as directed, this product is effective in controlling the spread of the fatal fungus Phytophthora lateralis [Port Orford Cedar Roost Disease] in areas of California and Oregon where Port Orford Cedar (Chamaecyparis lawsoniana) grows.

Water is commonly drafted from streams and fire ponds within forested areas to use in dust abatement on forest roads, equipment cleaning, and for fire suppression. The water source can spread the root disease fungus to uninfested areas. Treating water prior to use helps control the spread of the fungus.

Directions for Use: Add 1 gallon this product to 1000 gallons (~50 parts per million available chlorine) of drafted water. Prepare the mixture at least 5 minutes prior to application for dust abatement; fire suppression; and cleaning trucks, and logging, road building, and maintenance equipment.

DILUTION TABLE

Approximate available Chlorine	Volume of Bleach	Volume of Water
50	16 drops	1 quart
	¾ tsp.	1 gallon
	1 Tbsp. (1/2 oz)	4 ½ gallons
	2 ½ Tbsp.	10 gallons

PRECAUTIONARY STATEMENTS: HAZARDS TO HUMANS AND DOMESTIC ANIMALS

DANGER: CORROSIVE
May cause severe irritation or damage to eyes and skin. Harmful if swallowed. Protect eyes when handling. For prolonged use, wear gloves. Wash after contact with product. Avoid breathing vapors and use only in a well-ventilated area.

FIRST AID IF IN EYES: Rinse with plenty of water for 15 minutes. Get prompt medical attention. IF SWALLOWED: Drink large amounts of water. DO NOT induce vomiting. Call a physician or poison control center immediately. IF IN CONTACT WITH SKIN: wash skin thoroughly with water.

PHYSICAL OR CHEMICAL HAZARDS: Product contains a strong oxidizer. Always flush drains before and after use. Do not use or mix with other household chemicals, such as toilet bowl cleaners, rust removers, acids, or products containing ammonia. To do so will release hazardous irritating gases. Prolonged contact with metal may cause pitting or discoloration.

For Institutional use only:
ENVIRONMENTAL HAZARDS: Do not discharge effluent containing this product into lakes, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge System (NPDES) permit and the permitting authority has been notified in writing prior to discharge.

STORAGE AND DISPOSAL: Store this product upright in a cool, dry area, away from direct sunlight and heat to avoid deterioration. In case of spill, flood areas with large quantities of water. Small quantities of spilled or unusable product should be diluted with water before disposal in a sanitary sewer. Do not reuse empty container, but rinse and place in trash or recycle where facilities accept colored HDPE bottles. Do not contaminate water, food, or feed by storage, disposal or use of this product. Store away from children. Reclose cap tightly after each use. Offer empty container for recycling. If recycling is not available, discard container in trash. DO NOT allow product [and/or rinsate] to enter storm drains, lakes, streams, or other bodies of water.

CLOROX CUSTOMER ASSISTANCE (800) 292-2200

Appendix 5: Monitoring Plans for Each Alternative

Alternative 1

Alternative 1 is covered by existing land and resource management plan monitoring plans.

Alternatives 2–5

To maintain POC as an ecologically and economically significant species on BLM- and NF-administered lands, management strategies (both actions and inactions) will be evaluated.

Implementation Monitoring — Questions

1) Have resistance breeding and genetic conservation requirements been met?

2) Are general requirements for maintaining and reducing the risk of PL infections being implemented? Note: For Alternative 2, these are listed under General Direction.

3) Are project-specific management actions applied as required?

Implementation Monitoring — Requirements

1) The "Dorena Port-Orford-Cedar Interagency Agreement" will address current accomplishments including levels of established conservation seedbanks in its annual report.

2) The BLM Coos Bay, Medford, and Roseburg Districts will report in their annual program summaries, and the Siskiyou NF in its annual monitoring and evaluation report, the general activities accomplished for maintaining and reducing the risk of PL infections.

3) Administrative units will incorporate POC management actions into their existing project-specific implementation monitoring programs.

Effectiveness and Validation Monitoring — Questions

1) Is the genetic resistance program producing POC seedlings that survive long term under field conditions?

2) Are disease-controlling mitigation measures such as road use restrictions and closures, sanitation, and washing, effective as predicted, and is the risk associated with projects such as fire suppression at presumed or predicted levels?

3) Has the spread or non-spread of the disease significantly departed from the predictions made in this SEIS that were used to select a management strategy?

4) [Under Alternative 3 only] Is the disease being kept out of the 32 uninfested 6th field watersheds and if not, have appropriate eradication treatments been tried and are they successful?

Effectiveness and Validation Monitoring—Requirements

1) The "Dorena Port-Orford-Cedar Interagency Agreement" will report annually survival results of validation studies that determine effectiveness of the genetic resistance program.

2) The USDA-FS Southwest Oregon Forest Insect and Disease Service Center will continue to evaluate and coordinate existing management techniques to reduce the occurrence of PL and retain healthy POC. Emphasis will be directed towards ongoing projects and monitoring their results. Actual monitoring will be split between the Service Center and the administrative units where management occurs. Additional (new) monitoring efforts will be a function of available budget and workforce. In some cases, university research will be the appropriate vehicle to accomplish evaluations of management techniques.

3) As new inventory data (continuous vegetation survey and forest inventory and analysis) and local mapping becomes available, it will be evaluated for current levels (acres and/or number of trees) of infected and uninfected POC and corresponding trends. Inventory plots are typically re-inventoried on a 3- to 10-year cycle, depending upon location.

4) [Alternative 3 only] Road, aerial, or photo surveys of the uninfested watersheds will be done to identify new infestations at least once every 2 years.

Appendix 6: Port-Orford-Cedar Seed and Seedling Deployment Strategy

Note: This Strategy applies to Alternatives 2, 3, and 4.

Each Federal administrative unit within the natural range of POC would prepare a POC deployment strategy by the beginning of Fiscal Year 2006. Standards and guidelines, developed by each respective Federal agency, are to be coordinated with adjacent Agencies to coordinate common deployment efforts. Resistant seed for several breeding zones became available in the fall of 2002. The potential availability of surplus Federal POC seed or seedlings for use by state and private landowners should also be considered.

The deployment strategy should specifically address:

1) The creation and maintenance of a POC conservation seedbank at the administrative unit level, reserved for supporting overall reforestation efforts after a catastrophic event as described in the Genetics section of this alternative;

2) the creation and maintenance of an operational POC seedbank to be used for fulfilling routine silvicultural seed needs;

3) determination of the most appropriate mix of resistant and non-resistant POC stock, along with determining species ratios (especially where species such as western red cedar and incense cedar may share similar structural attributes and can help address functionality of riparian ecosystems) to be planted on a given type of site;

4) prioritize the planting of POC seedlings on a project basis (including replacement of POC killed by PL to desired stand densities by favoring the use of resistant stock, and reintroducing POC to small areas of its natural range where it has been eliminated);

5) determining the appropriate use of planting POC stock in respect to different harvest cuts (including underplanting);

6) insuring that spacing requirements, as defined in Management Practice 10, are considered on a project basis; and

7) integrating the use of resistant stock with other management techniques such as prescribed fire.

Resistant stock will be used in a manner which does not compromise the health of natural stands. In addition, deployment and priority for use will be established in order to use the stock in the most efficient manner. Resistant stock will be planted, on a hierarchy basis, as follows:

- Within the natural range of POC;
- where POC has been severely reduced from mortality caused by PL on a micro-

watershed scale, and where ecosystem function has been or could be adversely impacted in the future;

- compatible with, and compliments existing land-use allocation objectives;
- avoiding planting areas where there is a high probability of infection if there also exists a high probability that this infection can spread to uninfected POC within, near, or downstream of the site; and
- planting favorable microsites for survival (for example, convex slopes in the upper portions of riparian areas).

Appendix 7: Biological Evaluations

Wildlife

Threatened and Endangered Species

Implementation of any of these alternatives would result in a may affect, not likely to adversely affect on the northern spotted owl and a may affect on the critical habitats of the northern spotted owl and marbled murrelet.

Northern Spotted Owl (*Strix occidentalis caurina*)

Management of the northern spotted owl and its habitat on federally-managed lands was an important consideration in the design of the Northwest Forest Plan. This species received extensive attention in the Northwest Forest Plan final SEIS and its supporting documents.

Environmental Consequences: All requirements of the land management plans/resource management plans and ESA would be fulfilled prior to implementation of specific projects.

Alternatives 1 and 2. These alternatives do not prescribe any loss of suitable nesting, roosting, foraging, or dispersal habitat. POC, potentially even suitable nest trees, would be removed as a component of roadside sanitation efforts. Within areas subjected to sanitation there are potentially up to 9 acres (75 feet x 5,280 feet) of habitat per mile of road; within upland habitats in the righ-risk portion of its range, POC may comprise up to 40 percent of the total overstory cover (see Table 3&4-13). The ability of the adjacent stands to function for the northern spotted owl would not be changed. Road closures and seasonal use restrictions would reduce disturbance associated with road use and adjacent nesting habitat, benefiting northern spotted owls. Many of the roads to be closed or seasonally restricted are low use roads, so benefits may be relatively small. All provisions provided for the northern spotted owl in current resource management plans/land management plans would be implemented.

About 74 percent of the Federal landscape within the analysis area is within reserves other than riparian. The remaining 26 percent is Matrix/Riparian Reserve. The Northwest Forest Plan projected that less than 4 percent of the remaining late-successional forest would be harvested per decade. Actual harvest has been well below that rate. Based on the harvest rate in the last 8 years, late-successional forests have been harvested at less than 2.5 percent for the first decade. The reduced rate of harvest is due primarily to greater than expected riparian reserve coverage, the effects of Survey and Manage mitigation measures, and legal challenges. Harvest of late-successional forests under both alternatives would not exceed the rate anticipated in the Northwest Forest Plan final SEIS.

Implementation of Alternatives 1 and 2 in 100 years would result in approximately 17 percent of POC not currently infected with PL in the North Coast Risk Region, 20 percent in the Siskiyou Risk Region, and 28 percent in the Inland Siskiyou Risk Region to become infected with PL. POC is currently a component of stands on 271,367 acres in Oregon, 17.6 percent of the Federal land base. Impacts to POC loss is expected to be most severe in ultramafic plant associations (11 percent) where it often constitutes up to 35 to 40 percent of the overstory cover.

Alternative 3. This alternative creates a system of POC buffers and cores within 32 6th field watersheds that are currently uninfested with PL (505,329 acres; 33 percent of the analysis area). Timber harvests would be eliminated on 28,086 acres in the POC cores; this restriction does not preclude salvage options in the case of a stand-replacing event. Timber harvests and other activities would be restricted on 2,600 acres of Matrix lands. Additionally, all POC less than 10 inches dbh (diameter at breast height) would be removed along all roads within the POC cores. There are approximately 9 acres per mile of road. The loss of these smaller diameter trees would not affect the adjacent stands' functionality. Road closures and seasonal use restrictions would reduce disturbance associated with road use and adjacent nesting habitat and benefit northern spotted owls. Many of the roads to be closed or seasonally restricted are low use roads, so benefits may be relatively small. Within POC buffer areas future infestation of PL would be eradicated. Areas outside of the POC buffers and cores would be managed similar to Alternatives 1 and 2.

About 74 percent of the Federal landscape within the analysis area is within reserves other than riparian. The remaining 26 percent is Matrix/Riparian Reserve. The Northwest Forest Plan projected that less than 4 percent of the remaining late-successional forest would be harvested per decade. Actual harvest has been well below that rate. Based on the harvest rate in the last 8 years, late-successional forests have been harvested at less than 2.5 percent for the first decade. The reduced rate of harvest is due primarily to greater than expected Riparian Reserve coverage, the effects of Survey and Manage mitigation measures, and legal challenges. Harvest of late-successional forest under both alternatives would not exceed the rate anticipated in the Northwest Forest Plan final SEIS.

Implementation of Alternative 3 in 100 years would still result in approximately 16 percent of POC not currently infected with PL in the North Coast Risk Region, 15 percent in the Siskiyou Risk Region, and 19 percent in the Inland Siskiyou Risk Region to become infected with PL. POC is currently a component of stands on 271,963 acres in Oregon; 17.6 percent of the Federal land base. Impacts to POC loss is expected to be most severe in ultramafic plant associations (11 percent), where it constitutes up to 35 to 40 percent of the overstory cover.

Alternatives 4 and 5. These alternatives allow for the progression of PL across the landscape. There are no active management actions planned that would cause the direct loss or modification of suitable nesting, roosting, foraging, or dispersal habitat. PL resistant stocks of POC would be used to restore POC to the landscape.

Implementation of Alternatives 4 and 5 in 100 years would still allow approximately 19 percent of POC not currently infected with PL in the North Coast Risk Region, 34 percent in the Siskiyou Risk Region, and 50 percent in the Inland Siskiyou Risk Region to become infected with PL. POC is currently a component of stands over 271,963 acres in Oregon; 17.6 percent of the Federal land base. Impacts to POC loss is expected to be most severe in ultramafic plant associations (11 percent), where it constitutes up to 35 to 40 percent of the overstory cover. Similar effects may occur in other plant associations on granitic or diorite soils.

These alternatives could result in the modification of occupied or potentially occupied spotted owl habitat due loss of, or, impacts to suitable nesting, roosting, or foraging habitat. None of the alternatives should modify or remove sufficient nesting, roosting, or foraging habitat from any one stand to cause or degrade in habitat classification; either from nesting to dispersal or dispersal to non-habitat. Project specific analysis/consultation will be conducted to mitigate site specific impacts, where capable, and meet the intents of the National Environmental Policy Act, the Endangered Species Act, and planning regulations. Therefore, these alternatives may affect, but are not likely to adversely affect the northern spotted owl.

These alternatives could result in the modification of spotted owl critical habitat by causing the removal of individual, large-diameter trees capable of providing nesting substrate and the modification of suitable nesting, roosting, foraging habitat and dispersal habitats. None of the alternatives should modify or remove sufficient nesting, roosting, or foraging habitat from any one stand to cause degradation in habitat classification; either from nesting to dispersal or dispersal to non-habitat. Project specific analysis/consultation will be conducted to mitigate site specific impacts, where capable, and meet the intents of the National Environmental Policy Act, the Endangered Species Act, and planning regulations. Therefore, these alternatives may affect northern spotted owl critical habitat.

Marbled Murrelet (*Brachyramphus marmorata*)

The management strategy for marbled murrelets in the Northwest Forest Plan includes two primary components: (1) protection and development of marbled murrelet nesting habitat inside the large reserves near the coast; and (2) retention of all current and future known marbled murrelet nest sites in all land allocations and protecting occupied habitat. POC contributes to the overall ability of the surrounding stand to function as marbled murrelet nesting habitat, but serves as an inferior nesting platform because of its limb structure.

Environmental Consequences: Under all alternatives the level of protection for currently occupied marbled murrelet habitat would not be changed; all habitat disturbing activities would have pre-project surveys accomplished and known and future nest sites would be protected. All requirements of the land management plans/resource management plans and ESA would be fulfilled prior to implementation of specific projects.

Alternatives 1 and 2. Alternatives 1 and 2 do not prescribe any loss of suitable nesting habitat. POC, potentially even suitable nest trees, would be removed as a component of roadside sanitation efforts. Within areas subjected to sanitation there are potentially up to 9 acres (75 feet x 5,280 feet) of habitat per mile of road; within upland habitats in the high-risk portion of its range POC may comprise up to 40 percent of the total overstory cover. The ability of the adjacent stands to function for the marbled murrelet would not be changed. Road closures and seasonal use restriction would reduce disturbance associated with road use and adjacent nesting habitat and benefit marbled murrelets. Many of the roads to be closed or seasonally restricted are low use roads, so benefits may be relatively small. All provisions provided for the marbled murrelet in current resource management plans/land management plans would be implemented.

About 74 percent of the Federal landscape within the analysis area is within reserves other than riparian. The remaining 26 percent is Matrix/Riparian Reserve. The Northwest Forest Plan projected that less than 4 percent of the remaining late-successional forest would be harvested per decade. Actual harvest has been well below that rate. Based on the harvest rate in the last 8 years, late-successional forests have been harvested at less than 2.5 percent for the first decade. The reduced rate of harvest is due primarily to greater than expected riparian reserve coverage, the effects of Survey and Manage mitigation measures, and legal challenges. Harvest of late-successional forest under both alternatives would not exceed the rate anticipated in the Northwest Forest Plan final SEIS.

Implementation of Alternatives 1 and 2 in 100 years would still result in approximately 17 percent of POC not currently infected with PL in the North Coast Risk Region, 20 percent in the Siskiyou Risk Region, and 28 percent in the Inland Siskiyou Risk Region to become infected with PL. POC is currently a component of stands on 271,367 acres in Oregon; 17.6 percent of the federal land base. Impacts to POC loss is expected to be most severe in ultramafic plant associations (11 percent), where it constitutes up to 35 to 40 percent of the overstory cover.

Alternative 3. Alternative 3 creates a system of POC buffers and cores within 23 6th field watersheds that are currently uninfested with PL (505,329 acres; 33 percent of the planning area). Timber harvests would be eliminated on 28,086 acres in the POC cores; this restriction does not preclude salvage options in case of a stand-replacing event. Timber harvests and other activities would be restricted on 2,600 acres of Matrix lands. Additionally, all POC less than 10 inches dbh (diameter at breast height) would be removed along all roads within the cores. There are approximately 9 acres per mile of road. The loss of these smaller diameter trees would not affect the adjacent stands' functionality. Road closures and seasonal use restriction would reduce disturbance associated with road use and adjacent nesting habitat and benefit marbled murrelet. Many of the roads to be closed or seasonally restricted are low use roads so benefits may be relatively small. Within POC buffer areas future infestation of PL would be eradicated. Areas outside of the POC buffers and cores would be managed similar to Alternatives 1 and 2.

About 74 percent of the Federal landscape within the analysis area are in reserves other than riparian. The remaining 26 percent is Matrix/Riparian Reserve. The Northwest Forest Plan projected that less than 4 percent of the remaining late-successional forest would be harvested per decade. Actual harvest has been well below that rate. Based on the harvest rate in the last 8 years, late-successional forests have been harvested at less than 2.5 percent for the first decade. The reduced rate of harvest is due primarily to greater than expected riparian reserve coverage, the effects of Survey and Manage mitigation measures, and legal challenges. Harvest of late-successional forests under both alternatives would not exceed the rate anticipated in the Northwest Forest Plan final SEIS.

Implementation of Alternative 3 in 100 years would still result in approximately 16 percent of POC not currently infected with PL in the North Coast Risk Region, 15 percent in the Siskiyou Risk Region, and 19 percent in the Inland Siskiyou Risk Region to become infected with PL. POC is currently a component of stands over 271,963 acres in Oregon; 17.6 percent of the Federal land base. Impacts to POC loss is expected to be most severe in ultramafic plant associations (11 percent), where it constitutes up to 35 to 40 percent of the overstory cover. Similar effects may occur in other plant associations on granitic or diorite soils.

Alternatives 4 and 5. Alternatives 4 and 5 allow for the natural progression of PL across the landscape. There are no active management actions planned that would cause the direct loss or modification of suitable nesting habitat. PL resistant stocks of POC would be used to restore POC to the landscape.

Implementation of Alternatives 4 and 5 would still allow approximately 19 percent of POC not currently infected with PL in the North Coast Risk Region, 34 percent in the Siskiyou Risk Region, and 50 percent in the Inland Risk Region to become infected with PL. POC is currently a component of stands on 271,963 acres in Oregon; 17.6 percent of the Federal land base. Impacts to POC loss is expected to be most severe in ultramafic plant associations (11 percent), where it constitutes up to 35 to 40 percent of the overstory cover.

Northwest Forest Plan requirements to survey suitable marbled murrelet habitat prior to implementing any habitat disturbing activities will not be modified by this plan. Project specific analysis/consultation will be conducted to mitigate site specific impacts, where capable, and meet the intents of the National Environmental Policy Act, the Endangered Species Act, and planning regulations. Therefore, these alternatives have no affect to the marbled murrelet.

These alternatives could result in the modification of potential nesting habitat by causing the removal of individual, large-diameter trees capable of providing nesting substrate and/or the modification of within 0.5 miles of individual trees with potential nesting platforms, and with a canopy height of at least one-half the site-potential tree height. None of the alternatives should modify or remove sufficient nesting, roosting, or foraging habitat from any one stand to cause degradation in habitat classification from nesting to non-habitat. Project specific analysis/consultation will be conducted to mitigate site specific impacts, where capable, and meet the intents of the National Environmental Policy Act, the Endangered Species Act, and planning regulations. Therefore, these alternatives may affect marbled murrelet critical habitat.

Bald Eagle (*Haliaeatus leucocephalus*)

The Agencies survey extensively for bald eagles. Management of the bald eagle includes preparation of site-specific management plans and providing protection zones and management areas, as needed, to the species and its habitat. All requirements of the land management plans/resource management plans and ESA would be fulfilled prior to implementation of specific projects.

Environmental Consequences:

Alternatives 1 and 2. There is the small potential for the loss of suitable nest trees as a component of roadside sanitation. POC, potentially even suitable nest trees, would be removed as a component of roadside sanitation efforts. Within areas subjected to sanitation there are potentially up to 9 acres (75 feet x 5,280 feet) of habitat per mile of road; within upland habitats in the high-risk portion of its range POC may comprise up to 40 percent of the total overstory cover. Road closures and seasonal use restrictions would reduce disturbance associated with road use and adjacent nesting habitat and benefit the bald eagle. Many of the roads to be closed or seasonally restricted are low use roads so benefits may be relatively small.

Implementation of Alternatives 1 and 2 in 100 years would still allow approximately 17 percent of POC not currently infected with PL in the North Coast Risk Region, 20 percent in the Siskiyou Risk Region, and 28 percent in the Inland Siskiyou Risk Region to become infected with PL. POC is currently a component of stands over 271,963 acres in Oregon;

17.6 percent of the Federal land base. Impacts to POC loss is expected to be most severe in ultramafic plant associations (11 percent), where it constitutes up to 35 to 40 percent of the overstory cover.

Alternative 3. This alternative creates a system of POC buffers and cores within 23 6th field watersheds that are currently uninfested with PL (505,829 acres; 33 percent of the analysis area). Timber harvests would be eliminated on 28,086 acres in the POC cores; this restriction does not preclude salvage options in case of a stand-replacing event. Timber harvests and other activities would be restricted on 2,600 acres of Matrix lands. Additionally, all POC less than 10 inches dbh (diameter at breast height) would be removed along all roads within the POC cores. There are potentially 9 acres per mile of road. The loss of these smaller diameter trees would not affect suitable nesting habitat. Road closures and seasonal use restrictions would reduce disturbance associated with road use and adjacent nesting habitat. Many of the roads to be closed or seasonally restricted are low use roads, so benefits may be relatively small. Within POC buffer areas future infestation of PL would be eradicated.

Areas outside of the POC buffers and cores would be managed similar to Alternatives 1 and 2.

Implementation of Alternative 3 would still result in approximately 16 percent of POC not currently infected with PL in the North Coast Risk Region, 15 percent in the Siskiyou Risk Region, and 19 percent in the Inland Risk Region to become infected with PL. POC is currently a component of stands on 271,963 acres in Oregon; 17.6 percent of the Federal land base. Impacts to POC loss is expected to be most severe in ultramafic plant associations (11 percent), where it constitutes up to 35 to 40 percent of the overstory cover.

Alternatives 4 and 5. These alternatives allow for the progression of PL across the landscape. There is no active management planned that would cause the direct loss or modification of suitable nesting habitat. PL resistant stocks of POC would be used to restore POC to the landscape.

Implementation of Alternatives 4 and 5 in 100 years would still result in approximately 19 percent of POC not currently infected with PL in the North Coast Risk Region, 34 percent in the Siskiyou Risk Region, and 50 percent in the Inland Siskiyou Risk Region to become infected with PL. POC is currently a component of stands over 271,963 acres in Oregon; 17.6 percent of the Federal land base. Impacts to POC loss is expected to be most severe in ultramafic plant associations (11 percent), where it constitutes up to 35 to 40 percent of the overstory cover. Similar effects may occur in other plant associations on granitic or diorite soils.

These alternatives could result in the removal of individual, large-diameter trees that are capable of providing nesting structure of the bald eagle. Pre-project surveys, or prior monitoring efforts in the areas would indicate whether there are potential effects to the bald eagle. Project specific analysis/consultation will be conducted to mitigate site specific impacts, where capable, and meet the intents of the National Environmental Policy Act, the Endangered Species Act, and planning regulations. Therefore, these alternatives have no affect to the bald eagle.

Vernal pool fairy shrimp (Branchinecta lynchi)

This species does not require POC or forested habitats for critical components of its life history.

These alternatives will have no effect upon the habitat components of this species. Therefore, these alternatives have no affect to the vernal pool fairy shrimp.

Columbian white-tailed deer (Odocoileus virginianus leucurus)

The Columbian white-tailed deer is currently proposed for delisting within Douglas County, Oregon. The natural range of POC borders a portion of the known range of the Columbian white-tailed deer (Douglas County population) and any changes in amount of POC in those areas would have no effect upon the habitat to continue in its current capacity.

These alternatives will have no effect upon the habitat components of this species. Therefore, these alternatives have no affect to the Columbian white-tailed deer.

BLM Special Status Species

The BLM Special Status Species policy is applied to actions requiring authorization or approval by the Bureau to insure they are consistent with conservation needs of these species and do not contribute to the need to list them under the provisions of the ESA.

BLM special status species are as follows: Federal endangered, threatened, proposed and candidate species; State endangered and threatened species; Bureau Sensitive; Bureau Assessment; and Bureau Tracking. Those special status species occurring within the analysis area are listed in Table A7-1. None of the special status species listed in Table A7-1 are known to depend upon POC for habitat. Known sites for these species will continue to be managed as necessary to preclude the need to list them under the ESA for all alternatives.

For Bureau Sensitive or Bureau Assessment Species, the BLM requires review and assessment of potential effects, both beneficial and adverse, upon habitat considerations of each respective species. One or more of the following techniques may be used (BLM Instruction Memorandum No. OR-2003-054):

- Evaluation of species-habitat and presence of suitable or potential habitat;
- application of conservation strategies, plans, and other formalized conservation mechanisms;
- review of existing survey records, inventories, and spatial data;
- utilization of professional research, literature, and other technology transfer sources;
- use of expertise, both internal and external, that is based on documented, substantiated professional rationale; and/or
- complete pre-projects survey, monitoring, and inventory for species that are based on technically sound and logistically feasible methods while considering staffing and funding constraints.

Subsequently, the BLM requires conservation of Bureau Sensitive or Bureau Assessment species that are affected by their management actions. Options for conservation include but

Table A 7-1.– BLM special status[1] and FS sensitive[2] animal species that are documented or suspected to occur within the Coos Bay, Medford, and Roseburg BLM Districts and the Siskiyou National Forest[1] are not limited to:

a. Modifying a project (such as timing, placement, intensity or dropping);
b. using buffers to protect sites; and/or
c. implementing habitat restoration actions (i.e., actions to benefit a species).

For Bureau Tracking species, species-oriented inventories, environmental analysis, monitoring, protection, mitigation, management, and Fish and Wildlife Service technical assistance are optional.

For State Listed species, species-oriented inventories, protection, mitigation, management, and Fish and Wildlife Service technical assistance are optional (BLM Instruction Memorandum No. OR-91-57).

The BLM conducts pre-project clearances surveys for many special status species. Where surveys are done, they have a reasonable probability of locating individuals and populations of these species. Because surveys for special status species discover them and the agency will subsequently protect them as needed, there are no differences between the alternatives. Special status species are not expected to be influenced by any of the alternatives.

Forest Service Sensitive Species

Forest Service policy is to not contribute to the need to list Forest Service Sensitive species under the provisions of the ESA and to conduct habitat examinations when proposed resource activities or uses would potentially make influential changes to elements of their habitat. Such examinations are usually required for Forest Service Sensitive species unless the habitat is assumed occupied or prior surveys of the area are adequate. Pre-disturbance surveys can have several objectives including:

- Assessing potential sensitive species habitat;
- searching suitable habitat for sensitive species occurrence;
- confirming known habitat is suitable; and
- refining knowledge of how habitat exists on the landscape and how species use their habitat. This could include travel corridors, relationships between cover and forage areas, human disturbances, and fragile habitat situations.

The Forest Service Sensitive species program includes species for which there is a documented concern for viability within one or more administrative units within the species' historic range (FSM 2670.22, WO Amendment 2600-95-7). The designation of sensitive carries a requirement to analyze the impacts of projects and, frequently to conduct surveys (FSM 2670). Forest Service Sensitive species in the analysis area are listed in Table A7-1.

None of the Forest Service Sensitive species listed in Table A7-1 are dependent upon POC for habitat. Under all of the alternatives, known sites for these species will continue to be managed as necessary to preclude the need to list them under the ESA.

The Forest Service conducts pre-project clearances for many Forest Service Sensitive species. Where surveys are conducted, there is a reasonable probability of locating individuals and populations of these species. Because surveys for Forest Service Sensitive species will discover them and the agency will protect them as needed, there are no differences between the alternatives. Forest Service Sensitive wildlife species are not expected to be influenced by any of the alternatives.

References

Chappell, C.B.; Crawford, R.C.; Barrett, C.; [and others]. 2002. Wildlife Habitats: Descriptions, Status, Trends, and System Dynamics. *In:* Johnson, D.H.; O'Neal, T.A. 2002. Wildlife-Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis.

Dillingham, C. 2003. Ecologist, Vegetation Management Solutions, USDA-FS Enterprise Team.

Johnson, D.H.; O'Neal, T.A., *eds.* 2002. Wildlife-Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis. p 736.

Miller, R.C. 2003. Wildlife Technician, Illinois Valley Ranger District, Siskiyou NF.

USDA-FS; USDI-BLM. 1994. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-successional and Old-growth Related Species Within the Range of the Northern Spotted Owl. Portland, OR. 322 p.

USDA-FS; USDI-BLM. 2000. Final Supplemental Environmental Impact Statement for Amendment to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines. Regional Ecosystem Office, Portland, OR.

USDA-FS; USDI-BLM. 2001. Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines. Portland, OR. p. 130+.

USDA-FS; USDI-BLM. 2003. Survey and Manage Species Summary of Recommendations Regarding Category Placement and Range Changes from the 2002 Annual Species Review.

USDI-BLM. 1996a [updated 2002]. Western Oregon Districts Transportation Management Plan. Oregon/Washington State Office, Portland, OR. 36 p.

Webb, L.O. 2003. Forest Wildlife Biologist, Rogue River and Siskiyou NFs, Grants Pass, OR.

Botany

This section discusses the expected effects to Federal endangered, threatened, proposed, and candidate plant species, where applicable, under the Endangered Species Act (ESA) of 1973, as amended, by the alternatives. This section also discusses the expected influential changes, if any, to habitat of BLM Bureau Sensitive and Bureau Assessment species and to Forest Service Sensitive species by each alternative.

The BLM requires the effects of a proposed action be assessed on Bureau Sensitive and Bureau Assessment species (BLM Instruction Memorandum No. OR-2003-054).

The Forest Service Sensitive Species program includes species for which there is a documented concern for viability within one or more administrative units within the species' historic range (FSM 2670.22, WO Amendment 2600-95-7). Proposed projects that may impact Forest Service Sensitive species must be analyzed and to develop conservation strategies where applicable (FSM 2670). This analysis satisfies the Forest Service biological evaluation requirement (FSM 2672.4).

Discussion of Alternatives

Alternative 1. This alternative is the current management direction for BLM districts and the Siskiyou NF. It seeks to reduce or prevent introduction of the pathogen into disease-free areas by closing roads into these areas during the wet season to prevent the spores being carried from infested to uninfested areas, analyzing the risk of introduction to disease-free areas, developing mitigation measures at the project level, and informing the public about the reasons for these measures.

Across the range of POC, areas with the highest presence of rare plants are primarily free of infestation, with the conspicuous exceptions of Whiskey Creek, narrow bands on the lower portions of Josephine Creek, and on the Middle Illinois River. Seasonal road closures and vehicle washing, mitigations for this alternative, prevent the introduction of noxious weeds and restrict unauthorized off-highway vehicles, thereby indirectly benefiting rare plants.

Alternative 2. This alternative is similar to Alternative 1, except that a risk key has been added for clarification of the environmental conditions that would trigger additional control or mitigation measures. Implementation of disease mitigating practices is expected to be more consistent because of the key.

The effects of Alternative 2 are similar to Alternative 1, in that implementation would reduce the rate of spread of the disease. Continued development of resistant POC stock would be available for timely replacement into important botanical habitats. Alternative 2 would assist in maintaining the long-term presence of POC in unique plant communities, which appear to be more abundant in high-risk areas.

Alternative 3. To the management actions of Alternative 2, Alternative 3 adds additional protection measures to 32 uninfested 6th field watersheds with at least 100 acres occupied by POC. It divides these watersheds into POC cores and buffers and applies additional standards and guidelines to each to lessen introduction of infestation into those areas.

The effects of Alternative 3 are the same as Alternative 2, with the exception of effects within the 32 uninfested watersheds. In these watersheds, the prohibition of harvest and discretionary use in POC cores would ensure a lasting presence of POC in unique plant communities, which appear to be more abundant in high-risk areas. Closing roads and lessening unauthorized off-highway vehicles may benefit rare plant communities throughout the watersheds by preventing disturbances such as noxious weed introductions throughout the watersheds.

Alternative 4. This alternative would remove all preventive measures that are in place and will speed up the resistance breeding program to more quickly replace POC killed by the disease with resistant seedlings.

The effects of Alternatives 4 and 5 are similar, differing in the mid- and long-term where Alternative 4 would impede advancement of the disease by increasing the introduction of resistant stock.

Alternative 5. This alternative would remove all preventative measures and discontinue the development of the resistant breeding program. Existing resistant seed orchard trees would continued to be used to reforest areas of mortality in breeding for which resistant stock is already developed.

The effects of Alternatives 4 and 5 are similar, differing in the mid- and long-term where Alternative 5 depends upon the natural, low-level disease resistance and range-wide distribution for the continued existence of POC.

Alternatives 4 and 5 would substantially increase advancement of the disease compared to the current direction. The effect of this high POC mortality on rare plants is unpredictable. POC is a large component of riparian habitats in areas where it is the largest tree species present. Loss of shade and stream bank stability that may result from the loss of POC could influence sensitive and rare plant communities adapted to stream microsites.

Threatened and Endangered Species

The BLM and the Forest Service survey for listed and proposed for listing plant species in and adjacent to proposed project areas. These surveys are designed to have a high likelihood of locating populations of these plant species. Because surveys for listed or proposed plant species will discover and subsequently protect these species with mitigation measures, there would be no difference between the five alternatives. Hence, these alternatives would have "no effect" to the endangered or threatened plant species listed in Table A7-2.

All projects proposed on BLM- or FS-administered land must meet the Aquatic Conservation Strategy objectives of the Northwest Forest Plan. As proposed projects are designed and analyze for effects to listed plants, needs of the plant species and habitat elements required to meet Aquatic Conservation Strategy objectives will be identified.

BLM Bureau Sensitive or Bureau Assessment Species

The BLM special status species policy is applied to actions requiring authorization or approval by the Bureau to insure they are consistent with conservation needs of special status species, which include Bureau Sensitive and Bureau Assessment species, and do not contrib-

Table A7-2.– Threatened (T) or endangered (E) vascular plants within the range of Port-Orford-cedar[1]

ute to the need to list them under the provisions of the ESA.

For Bureau Sensitive or Bureau Assessment species, the BLM requires review and assessment of potential effects, both beneficial and adverse, upon habitat considerations of each respective species. One or more of the following techniques may be used (BLM Instruction Memorandum No. OR-2003-054):

- Evaluation of species-habitat and presence of suitable or potential habitat;
- application of conservation strategies, plans, and other formalized conservation mechanisms;
- review of existing survey records, inventories, and spatial data;
- utilization of professional research, literature, and other technology transfer sources;
- use of expertise, both internal and external, that is based on documented, substantiated professional rationale; and/or
- complete pre-projects survey, monitoring, and inventory for species that are based on technically sound and logistically feasible methods while considering staffing and funding constraints.

Subsequently, the BLM requires conservation of Bureau Sensitive or Bureau Assessment species that are affected by their management actions. Options for conservation include but are not limited to:

a. Modifying a project (such as timing, placement, intensity or dropping);
b. using buffers to protect sites; and/or
c. implementing habitat restoration actions (i.e., actions to benefit a species).

The BLM conducts pre-project clearances surveys for many special status species. Where surveys are done, they have a reasonable probability of locating individuals and populations of these species. Because surveys for special status species will discover them and the agency will subsequently protect them as needed, there are no differences between the alternatives. Bureau Sensitive and Bureau Assessment species listed in Table A7-3 are not expected to be influenced by any of the alternatives.

Forest Service Sensitive Species

Forest Service policy is to not contribute to the need to list Forest Service Sensitive species under the provisions of the ESA and to conduct habitat examinations when proposed resource activities or uses would potentially make influential changes to elements of their habitat. Such examinations are usually required for Forest Service Sensitive species unless the habitat is assumed occupied or prior surveys of the area are adequate. Pre-disturbance surveys can have several objectives including:

- Assessing potential sensitive species habitat;
- searching suitable habitat for sensitive species occurrence;
- confirming known habitat is suitable; and
- refining knowledge of how habitat exists on the landscape and how species use their habitat. This could include travel corridors, relationships between cover and forage areas, human disturbances, and fragile habitat situations.

Within the range of POC, Table A7-3 lists Forest Service Sensitive species in Regions 5 (California) and 6 (Oregon). The Forest Service Sensitive species program includes species for which there is a documented concern for viability within one or more administrative units

Table A7-3.– Vascular plants listed as BLM Bureau sensitive/assessment and Forest Service sensitive documented or suspected within close proximity of Port-Orford-cedar within the species' historic range (FSM 2670.22, WO Amendment 2600-95-7). The designation of sensitive carries a requirement to analyze the impacts of projects and, frequently, to conduct surveys (FSM 2670).

The Forest Service conducts pre-project clearances for many Forest Service Sensitive species. Where surveys are conducted, there is a reasonable probability of locating individuals and populations of these species. Because surveys for Forest Service Sensitive species will discover them and the agency will protect them as needed, there are no differences between the alternatives. Forest Service Sensitive species listed in Table A7-3 are not expected to be influenced by any of the alternatives.

Contributors

Nancy Brian, Lisa Hoover, Mark Mousseaux, Julie K. Nelson, and Daniel Segotta.

References

Kagan, J. 1990a. Draft Species Management Guide for *Epilobium oreganum* Greene. [Developed for] the Siskiyou NF and Medford BLM District, [on file at] Six Rivers NF Supervisor's Office, Eureka, CA.

Kagan, J. 1990b. Draft Species Management Guide for *Gentiana setigera* Wats. [Developed for] the Siskiyou NF and Medford BLM District, [on file at] Six Rivers NF Supervisor's Office, Eureka, CA.

Kagan, J. 1996. Draft Conservation Agreement for *Hastingsia bracteosa*, *H. atropurpurea*, *Gentiana setigera*, *Epilobium oreganum*, and *Viola primulifolia* var. *occidentalis* and Serpentine Darlingtonia Fens and Wetlands from Southwestern Oregon and Northwestern California. [On file at] Six Rivers NF Supervisor's Office, Eureka, CA.

Skinner, M.W.; Pavlik, M.; *eds*. 1994. California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California. Sacramento, CA.

USDA-FS. 2001. Sensitive Species Plant List, Region 6, U.S. Forest Service. [On file at] Siskiyou NF Supervisor's Office, Grants Pass, OR.

USDA-FS. 2001. Sensitive Species Plant List, Region 5, U.S. Forest Service. [On file at] Six Rivers NF Supervisor's Office, Eureka, CA.

Hickman, J.C. 1993. The Jepson Manual of Higher Plants of California. University of California Press, Berkeley. 1,400 p.

Oregon Natural Heritage Program. 1997. Oregon Natural Heritage Program Data Base, Portland, OR.

USDA-FS. 1989. Siskiyou National Forest Land and Resource Management Plan. Siskiyou National Forest, Grants Pass, OR.

USDA-FS. 1999. Forest Service Manual: Wildlife, Fish, and Sensitive Plant Management (Section 2670), WO Amendment 2600-91-3 [effective 5/17/99].

USDA-FS. 1997. Sensitive and Endemic Plant Records and Plant Survey Records (1978–1997). [On file at] Siskiyou National Forest Supervisor's Office, Grants Pass, OR.

USDA-FS; USDI-BLM. 1994a. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-successional and Old-growth Related Species Within the Range of the Northern Spotted Owl. Portland, OR. 322 p.

USDA-FS; USDI-BLM. 1994b. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl. Portland, OR.

USDA-FS; USDI-BLM. 2001. Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines. Portland, OR. p. 130+.

Vorobik, L. 2002. Research Botanist, [personal communication (written report) regarding identification of *Arabis macdonaldiana* specimens].

Appendix 8: Areas of Critical Environmental Concern and Research Natural Areas and Requirements for Designation

Areas of Critical Environmental Concern

This appendix explains ACEC criteria as described in 3 CFR 16 and describes the existing and proposed ACECs and their relevant and important values (Tables A8-1 and A8-2). BLM regulations (43 CFR part 1610) define an ACEC as an area

> . . . within the public lands where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards.

ACECs differ from other special management designations such as wilderness study areas in that the designation, by itself, does not automatically prohibit or restrict other uses in the area. The one exception is that a mining plan of operation is required for any proposed

Table A8-1.— Areas of critical environmental concern and research natural areas within the range of Port-Orford-cedar in Oregon

Table A8-2.—Areas of critical environmental concern and research natural areas within the range of Port-Orford-cedar in Oregon

Area Name	POC/ PL	Acres	Primary objectives	Management
Medford BLM				
Eight Dollar Mountain ACEC		1,247	Special status plants and *Darlingtonia* wetlands.	Closed for timber harvest. Off-highway vehicle [OHV] use restricted to existing roads. Mineral leasing subject to no surface occupance [NSO]. Open to mineral entry. Acquisition needed.
Brewer Spruce ACEC/RNA	POC	390	Brewer spruce forest and aquatic cell for mid- to high-elevation permanent pond.	Not available for timber harvest. OHV use restricted to designated roads. Mineral leasing subject to NSO. Close to mineral entry.
Woodcock Bog ACEC/RNA	PL	280	*Darlingtonia* wetland on serpentine and special status plant species.	Not available for timber harvest. Closed to OHV use. Mineral leasing subject to NSO. Closed to mineral entry.
Bobby Creek ACEC/RNA	POC	428	Natural systems, botanical, special status species, and wildlife fisheries.	Not available for timber harvest. OHV use restricted to existing roads. Mineral leasing subject to NSO. 428 acres designated as ACEC and 1,702 acres designated as RNA.
Crooks Creek ACEC/RNA		149	Natural systems, wildlife, and special status species.	Not available for timber harvest. OHV use restricted to existing roads. Mineral leasing subject to NSO.
French Flat ACEC/RNA		656	Special status plants and plant communities.	Not available for timber harvest. OHV use restricted to existing roads. Mineral leasing subject to NSO. Closed to OHV.
Iron Creek ACEC/RNA		286	Natural systems, wildlife and botanical values.	Not available for timber harvest. OHV use restricted to existing roads. Mineral leasing subject to NSO.
Poverty Flat ACEC/RNA		29	Natural systems, vernal pool wetlands, and special status plants.	OHV use restricted to existing roads. Mineral leasing subject to NSO.
Rough and Ready ACEC/RNA	POC	1,164	Natural systems, special status plants, botanical.	Not available for timber harvest. OHV use limited to designated roads. Mineral leasing subject to NSO.
Bobby Creek ACEC/RNA	POC	1,702	Natural systems, botanical, special status species, and wildlife fisheries; moist tanoak forests [tanoak/Port-Orford-cedar/salal].	Not available for timber harvest. OHV use restricted to existing roads. Mineral leasing subject to NSO. 428 acres designated as ACEC and 1,702 acres designated as RNA.
Brewer Spruce Enlargement ACEC/RNA	POC	1,384	Natural area of Brewer spruce forest for scientific research and baseline study area.	Not available for timber harvest. Closed to OHV use. Mineral leasing subject to NSO. Closed to mineral entry.
Grayback Glade ACEC/RNA	POC	1,069	Terrestrial white-fir-Port-orford-cedar and aquatic first order stream for scientific research and baseline study area.	Not available for timber harvest. Closed to OHV use. Mineral leasing subject to NSO. Closed to mineral entry.
North Fork Silver Creek ACEC/RNA	POC	499	Douglas-fir/white fir forest with diverse shrub understory and third order stream; for scientific research and baseline study area.	Not available for timber harvest. Closed to OHV use. Mineral leasing subject to NSO. Closed to mineral entry. No surface disturbance within 100 feet of boundary.

mining activity within an ACEC. The ACEC designation is an administrative designation and is accomplished through the land use planning process. It is unique to the BLM in that no other agency uses this form of designation. The intent of Congress in mandating the designation of ACECs through the "Federal Land and Policy Management Act" was to give priority to the designation and protection of areas containing truly unique and significant resource values.

Research Natural Areas

According to Oregon Natural Heritage Program (ONHP) (ONHP 1993, 1998) the purpose for research natural areas (RNAs) are:

> ...to preserve examples of all significant natural ecosystems for comparison with those influenced by man; to provide educational and research areas for ecological and environmental studies; and to preserve gene pools of typical and endangered plants and animals.

All BLM RNAs are designated and managed as ACECs (Oregon Manual Supplement 1623.35 for RNAs only). Therefore, all RNAs must meet both the ACEC criteria, as applied in writing by an interdisciplinary team and approved by the field manager, as well as the need for a RNA cell as defined in the ONHP data base. The ACEC can be larger than the RNA, to encompass other values, which may not be needed for the RNA. RNA management plans are usually more restrictive than ACEC plans. RNA cells determined by the ONHP are the basic units that are represented in a natural area system. These cells can be an ecosystem, community, habitat, or organism. Cells are artificial constructs used by the ONHP to inventory, classify, and evaluate natural areas in Oregon. Cells contain one or more ecosystem elements. Typically, a RNA aggregates several cells that need representation. The ONHP was created by the Oregon Natural Heritage Advisory Council to the State Land Board in 1993. They are the State counterpart of the Federal program. Of the 16 existing and proposed ACECs, 13 have ONHP cells within their areas. Within the existing and proposed ACECs, 11 have existing or proposed RNAs.

Requirements for Designation

To be designated as an ACEC, an area must meet the relevance and importance criteria listed in BLM 1613 Manual (BLM 1988) and require special management. Specific evaluation questions for each of these three elements are listed below.

Relevance Criteria

Does the area contain one or more of the following:

- A significant historic, cultural, or scenic value;
- a fish and wildlife resource;
- a natural process or system; or
- a natural hazard?

Importance Criteria

Does the value, resource, system, process, or hazard described above have substantial significance or value? Does it meet one or more of the following criteria?

- Is it more than locally significant, especially compared to similar resources, systems, processes, or hazards within the region or Nation;
- does it have qualities or circumstances that make it fragile, sensitive, rare, irreplaceable, exemplary, unique, endangered, threatened, or vulnerable to adverse change;
- has it been recognized as warranting protection in order to satisfy national priority concerns or to carry out the mandates of the "Federal Land and Policy Management Act;"
- does it have qualities that warrant highlighting to satisfy public or management concerns about safety and public welfare; or
- does it pose a significant threat to human life and safety or property?

Need for Special Management

Does the value, resource, system, process, or hazard require special management to protect (or appropriately manage) the relevant/important value(s)? Special management is defined as or is needed when:

1) Current management activities are not sufficient to protect a given relevant/important resource value and a change in management is needed that is not consistent with the existing land use plan(s).

2) The needed management action is considered unusual or outside of the normal range of management practices typically used.

3) The change in management is difficult to implement without ACEC designation.

Evaluation Process

Regardless of who nominates an area as a potential ACEC, it is the BLM who is responsible for evaluating the area to determine if it meets the relevance/importance criteria and requires special management.

Appendix 9: Summary of Modeled Potential Stream Temperature Increases Resulting from Port-Orford-Cedar Mortality

To help identify sideboards to the affect of POC mortality on stream temperatures, the following scenarios were run on the stream SHADOW model, Version X-15 (Parks 1993). Mortality of POC is expected to have the largest affect on stream temperature on ultramafic soils, where (1) overall vegetation is less than on other soil types, (2) POC is more prominent along stream sides compared to other species, and (3) POC is less likely to be replaced by other species if it is lost. The model was run for 10 (cases 1, 2, and 3) and 40 (cases 4, 5, and 6) square mile drainages. Latitude is 43 degrees, solar declination is 17 degrees (August 1), and ground temperature is 53 degrees. Modeling parameters are shown in Table A9-1.

These parameters assume 100 percent POC within the first 15 feet from the stream channel for a mile (POC averages 50 percent of the overstory canopy in the 33,000 acres of riparian ultramafic plant associations in which it is prominent [Table 3&4-12]), and 100 percent kill for the 15 feet on either side of the channel, and zero kill beyond that distance. Results of conduction, convection, inflow, etc., were not modeled. The results of the temperature modeling are shown in Table A9-2.

Table A9-1.—Modeling parameters for SHADOW stream temperature effects

Table A9-2.—Summary of predicted shade decrease and temperature increase for August 1, comparison of uninfested and infested riparian areas with 100 percent POC

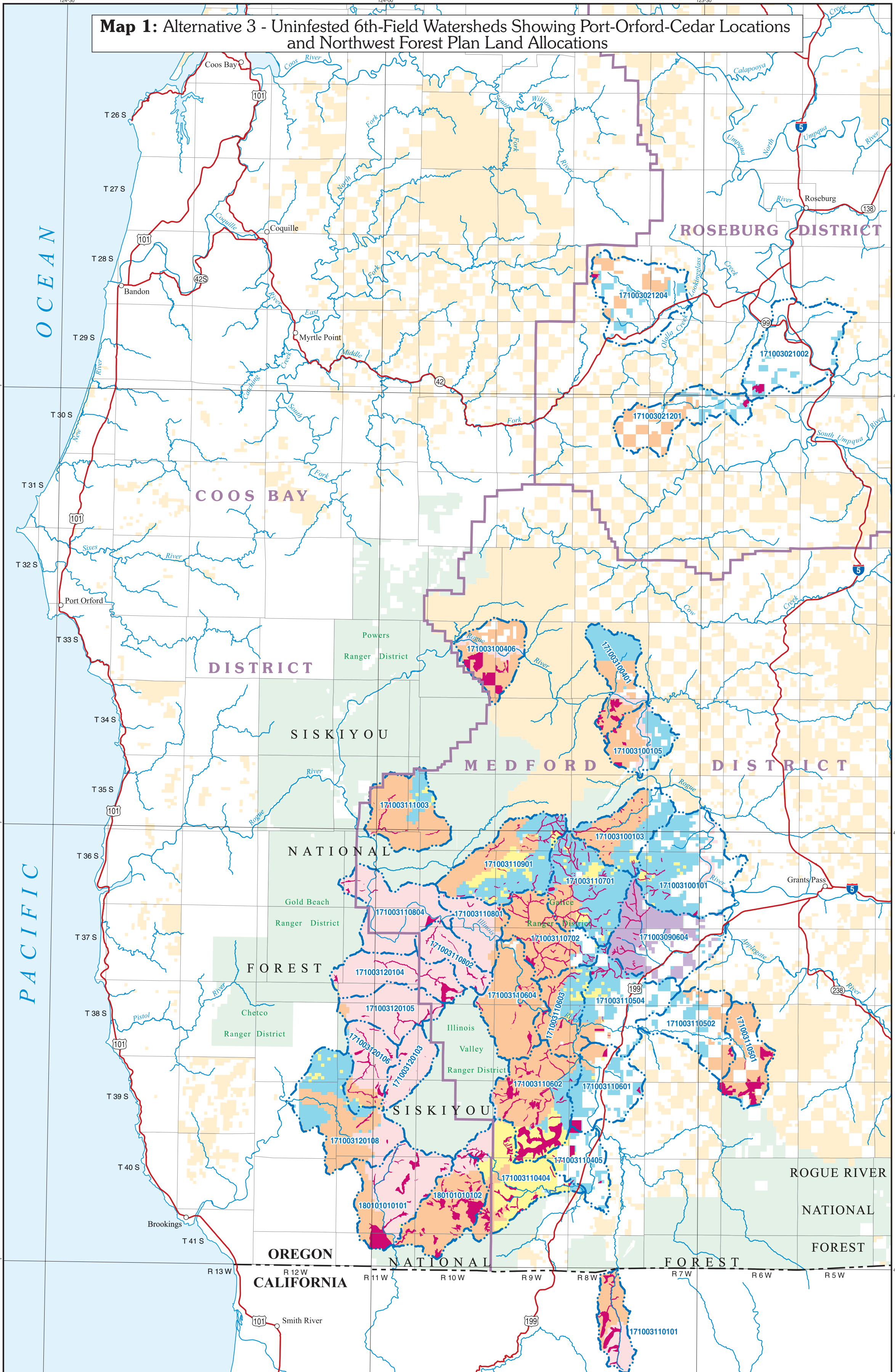
Maps

Map 1.– Alternative 3 Uninfested 6th Field Watersheds, showing POC locations and Northwest Forest Plan land allocations

Map 2.– Phytophthora lateralis (red) and Port-Orford-cedar by Northwest Forest Plan land allocation (all other colors) for the Oregon portions of the range

Map 3.– Port-Orford-cedar occurrence, range line, and ecoregions

Map 1: Alternative 3 - Uninfested 6th-Field Watersheds Showing Port-Orford-Cedar Locations and Northwest Forest Plan Land Allocations



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Draft Supplemental Environmental Impact Statement

June 2003

5 0 5 10 Miles
5 0 5 10 Kilometers

LEGEND

- Port-Orford-Cedar Core Uninfested with Root Disease
- Northwest Forest Plan Land Allocation
  - Adaptive Management Area
  - Administratively Withdrawn
  - Congressionally Withdrawn
  - Late-Successional Reserve
  - Riparian Reserve / Matrix
- BLM Land Outside Uninfested 6th-Field Subwatershed
- USFS Land Outside Uninfested 6th-Field Subwatershed
- Uninfested 6th-Field Subwatershed Boundary
- BLM District Boundary
- Major Stream (Order 1-5)

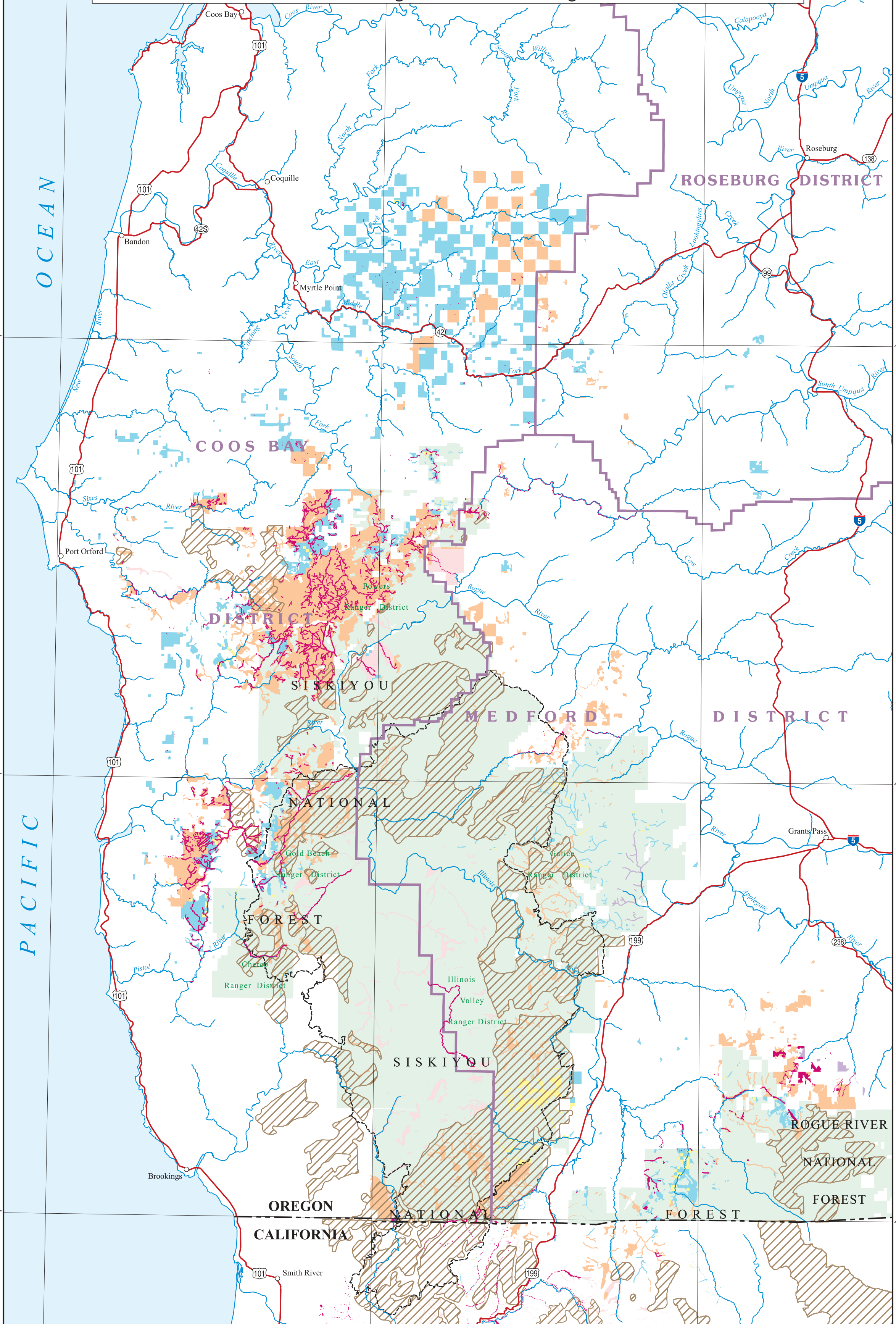
N E S W

Oregon
Area of Map
California

LOCATION MAP

D05-04-03

Map 2: Phytophthora Lateralis and Port-Orford-Cedar by Northwest Forest Plan Allocation for the Oregon Portions of the Range



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LEGEND

- Phytophthora Lateralis Infestation
- Port-Orford-Cedar Presence in their underlying Land Use Allocations [1]
  - Adaptive Management Area
  - Administratively Withdrawn
  - Congressionally Withdrawn
  - Late-Successional Reserve
  - Riparian Reserve / Matrix
- U.S. Forest Service Administered Land
- Roadless Area
- Biscuit Fire Perimeter
- BLM District Boundary

1 *The Port-Orford-Cedar areas inside the Biscuit Fire perimeter in areas greater than 75% topkill have been removed.*

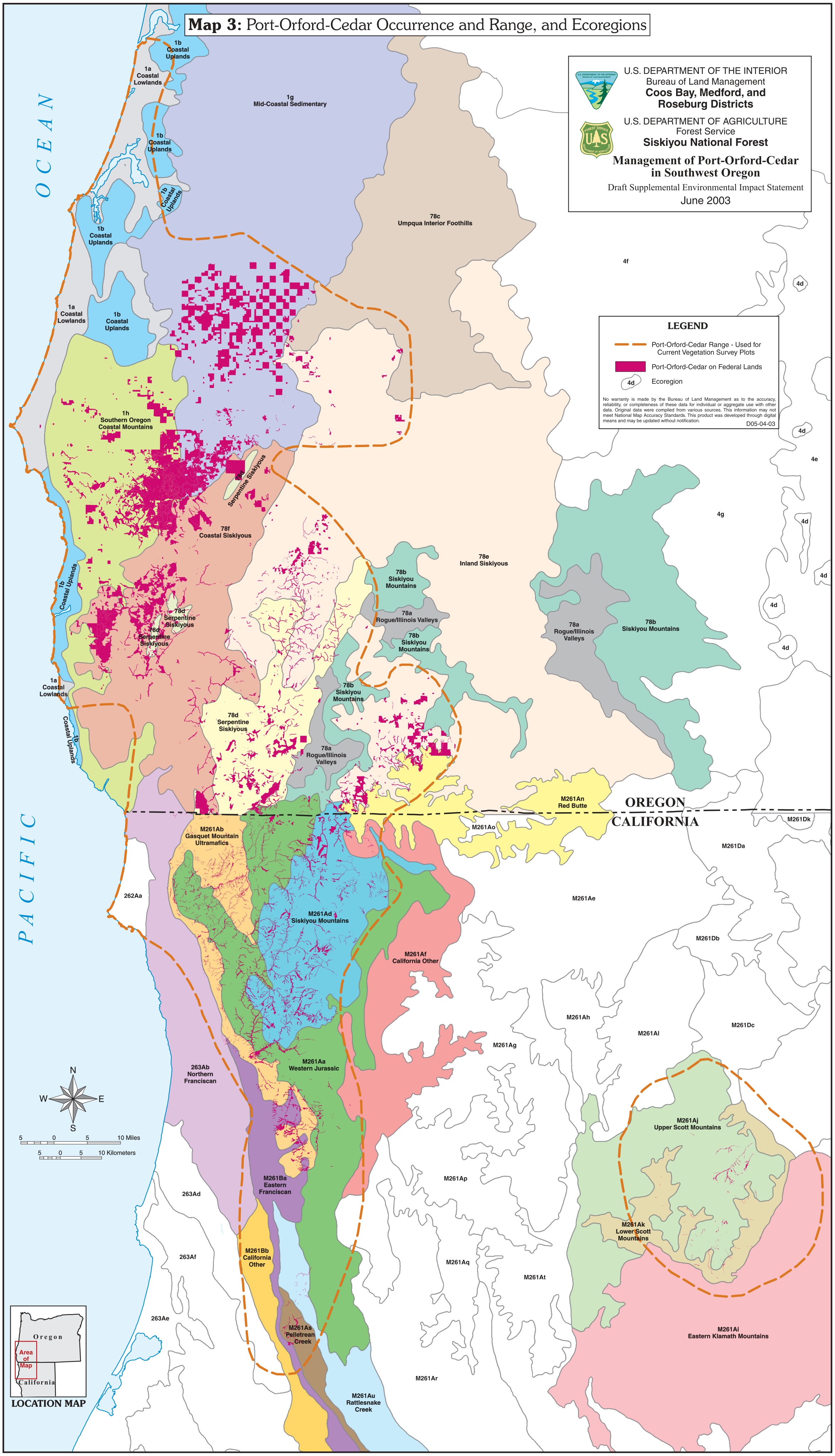
5 0 5 10 Miles

5 0 5 10 Kilometers

N S E W

Oregon
Area of Map
California
LOCATION MAP

D05-04-03



Map 3: Port-Orford-Cedar Occurrence and Range, and Ecoregions